Author:

Title: Potato storage investigations 1924 - 1925

Place of Publication: Canton, Pa.

Copyright Date: 1925?

Master Negative Storage Number: MNS# PSt SNPaAg084.10

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260 Canton, Pa. $bMarble Laboratory $c[1925?].
300 174 p. $bill. (some fold.) $c23 cm.
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POTATO STORAGE
INVESTIGATIONS

1924-1925

BY

COMMITTEE ON STORAGE INVESTIGATIONS
State of Pennsylvania .

A Co-Operative Investigation Participated in by Representatives of:

The United States Department of Agriculture
The Pennsylvania Department of Agriculture
The Pennsylvania State College
The Pennsylvania Growers
The Marble Laboratory Inc.

PUBLISHED BY
THE MARBLE LABORATORY INC.
CANTON, PA.

PERSONNEL OF THE COMMITTEE ON STORAGE INVESTIGATIONS

Appointed September 3, 1924, by Honorable F. P. Willits, Secretary of Agriculture, State of Pennsylvania

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Preface

CHARACTER AND SCOPE OF THE INVESTIGATION

THIS investigation has been called for by losses incurred in the storage of potatoes, both table stock and seed stock, at the Warehouse of the Potter Co-Operative Potato Association, Counderport, Pa. The Warehouse was built in the summer of 1922. During its first year's operation out of a total of 70,000 bushels stored, an amount estimated at from 70% to 80% was lost from storage rots and molds. During the storage season 1923-1924, while the loss was much reduced by changes in the building construction and by the introduction of a forced draft ventilating system, the storage loss in stock stored in bins was still considerable.

It seemed desirable to have an investigation conducted to examine into the fundamentals of potato storage.

It is desirable to delay germination of both table stock and seed stock until late in the spring. It is desirable to avoid loss from storage rots. It is desirable that the viability of the stored seed shall not be weakened during storage.

How to store so that these features can be realized is the object of the present investigation.

It was decided to conduct the investigation at The Marble Laboratory, Canton, Pa., because of the facilities there available for research work. The work carried on at the Marble Laboratory is reported in Sections I and II of this Report.

To determine the effect upon the viability of the stored seed of the different storage methods employed, plantings from the various lots of seed under test were made at the farm of R. W. Benjamin, Towanda, Pa. This work was carried on by representatives of the Bureau of Plant Industry, Pennsylvania Department of Agriculture, and is presented in Section III of this Report.

In Section IV of this Report a statement is given of an investigation carried on at the Coudersport Storage during the storage season 1924-1925, by representatives of the Bureau of Plant Industry, Pennsylvania Department of Agriculture. This work was concurrent with that carried on at The Marble Laboratory.

THIS REPORT IS PRESENTED IN FOUR DIVISIONS, AS FOLLOWS:

I

Report of the Investigational Work carried on at The Marble Laboratory Inc., Canton, Pa., 1924-1925

L. M. MARBLE

II

Report of the Condition of Potatoes in Experimental Storage in The Marble Laboratory at Canton, Pa., when stock entered storage, and also when stock was removed from storage, together with a discussion of the results

W. A. McCUBBIN
Plant Pathologist, Bureau of Plant Industry
Pennsylvania Department of Agriculture

III

Field Tests of Stored Potatoes

W. A. McCUBBIN AND R. E. HARTMAN
Bureau of Plant Industry
Pennsylvania Department of Agriculture

IV

Observation on Potato Storage Conditions at Coudersport Warehouse, 1924-1925

W. A. McCUBBIN
Plant Pathologist, Bureau of Plant Industry
Pennsylvania Department of Agriculture

I

Report of the Investigational Work carried on at The Marble Laboratory Inc., Canton, Pa., 1924-1925

I. Report on Investigational Work Carried on at The Marble Laboratory Inc., Canton, Pa.

L. M. MARBLE*

PROBLEMS COVERED BY THE INVESTIGATION

The storage of potatoes presents two main problems:

1. Delay of germination until the end of the storage term.
2. Avoidance of storage rots.

The work here reported has to do with the first of these problems. This work carried on upon storage rots is presented in the Second Section of the Report.

In considering means for bringing about delay in germination until the end of the storage term, the storage factors which have been examined are:

1. The type of storage, whether bin, crate or bag storage.
2. The influence of ventilation, and how it should be employed.
3. The temperature of storage.
4. The humidity of storage.
5. Sweating in storage.

VARIETIES USED

The investigations herein reported were centered on Potter County Russet Rural which, on account of the short growing season, are more or less immature when harvested. Since the storage of immature stock presents certain problems not encountered in mature stock, it was decided to store mature, as well as immature, Pennsylvania grown Russet Rural tubers; and for still further comparative purposes to store Michigan grown stock of this variety, as well as

* The technical work presented in this Report was carried on by R. B. Maxwell, of the Laboratory Staff. Charts, tables and graphs were prepared by him. The photographs were taken by Flora Lewis Marble.

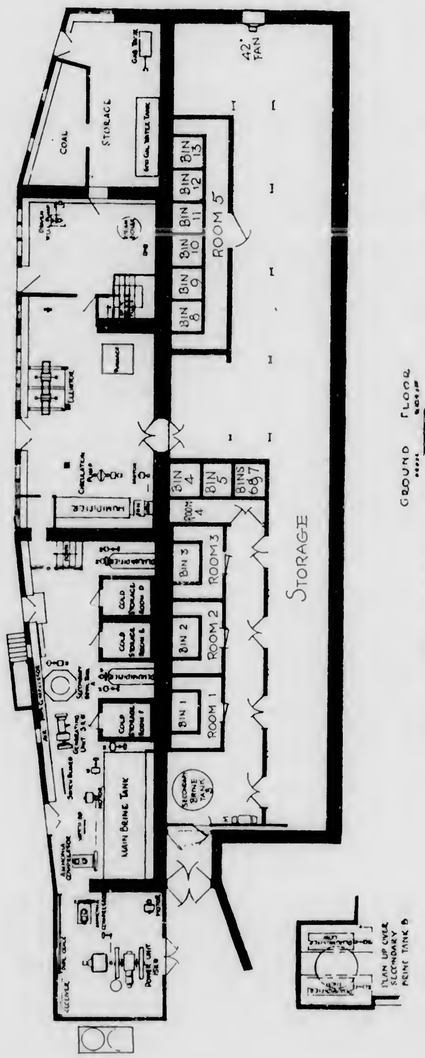

Figure 1

three other standard varieties. The list of the varieties finally decided upon with the locality where grown is as follows:

Variety	Where Grown
Russet Rural, immature,	Potter County, Pennsylvania.
Russet Rural, mature,	Bradford County, Pennsylvania.
Russet Rural,	Michigan.
White Rural, (Sir Walter Raleigh)	Bradford County, Pennsylvania.
Irish Cobbler,	Bradford County, Pennsylvania.
Green Mountain,	Berks County, Pennsylvania.

LOCATION, SIZE AND EQUIPMENT OF STORAGE ROOMS

Six storage rooms were provided, five of them being partitioned off from the main laboratory storage cellar, and a sixth, consisting of an old type bank storage cellar, located on the Laboratory grounds. The arrangement of the storage rooms in the main Laboratory Cellar is shown in Figure 1.

As bin, crate and bag storage with and without ventilation, and also storage temperature was to be studied, it was necessary to first decide upon a standard size bin to be used thruout the experiment in the various storage rooms.

The bin size determined was 5′x5′x8′ high. The sides were built of matched lumber and were made tight, so as to simulate the storage conditions prevailing in bulk storage of large quantities of potatoes. The front of the bins were built of boards placed one on top of the other and held in place by end cleats. The bottom of the bins in the rooms with ventilation were formed by a false floor, consisting of 2″ plank set 1″ apart, built 12″ above the earth floor, so as to make provisions for the introduction of the ventilating air. The bins in the room without ventilation were built directly upon the earth floor. This floor was covered with wire cloth to prevent injury from rodents. Owing to the size of the control rooms, it was necessary in some cases to modify the bin dimensions to 4′x6′x8′ high.

A standard burlap bag was used in bag storage and a standard slatted crate for crate storage.

It was decided to build one of the storage rooms without provi-

sion for ventilation other than the opening of the door into the storage room, and to provide the four other storage rooms in the main laboratory cellar with ventilation with fresh outside air.

The rooms with ventilation were numbered 1, 2, 3 and 4. The room without ventilation was numbered Room 5.

Two methods were used to determine the influence of ventilation:

1. Change in the amount of the ventilating air supplied.
2. Change in the depth of the bins.

There were four different rates of air change; namely,

One air change per hour,
Two air changes per hour,
Three air changes per hour,
Four air changes per hour.

In the room having four air changes per hour three different depths of bins were provided; namely, in addition to the 8′ bin, a 6′ bin and a 3′ bin.

One three foot bin was built above the first 3′ bin, with a 12″ air space between, according to the plan of Julian A. Dimock, Corinth, Vermont.

With four rates of air change and with three depths of bins, it was thought that the difference due to ventilation in bin storage would be apparent; while the comparison between bin storage in the room with ventilation and the room without ventilation would afford a further comparison on the effect of ventilation as an element in bin storage.

Storage Rooms 1, 2 and 3 were large enough to permit the construction within them of only one bin and in addition to furnish storage for the standard quantity of crates and bags used thruout the experiment. In the rooms with ventilation, bin storage was, therefore, restricted to one variety; namely, Potter County Russet Rural. In Room 4, an 8′ bin, a 6′ bin and two 3′ bins were constructed.

Room 5, the room without ventilation, was built large enough to allow the construction within it of six standard 5′x5′x8′ high bins, for each of the six varieties which were used in the experiment, and in addition to permit the storage within the room of crates and bags of the desired quantity.

A standard 5′x5′x8′ bin was built in the old cellar which simulated ordinary farm cellar storage. This is an underground storage cellar, 24′x16′x9′ high, with stone walls, concrete ceiling and concrete floor. The ceiling of the cellar is covered with an earth fill 3 feet deep. The cellar was provided with two air shafts, but the air shafts were closed during this experiment so that no outside ventilation was provided.

The optimum temperature for potato storage has been determined by many investigators to be 38-40° F. This temperature was accepted as the temperature to be maintained in Rooms 1, 2, 3, 4 and 5. Inasmuch, however, as one feature of this experiment was to consider bin storage in farm cellars as compared with bin storage in large bulk, such as is presented in warehouses, no effort was made to control the temperature in the old cellar, other than to keep the cellar from freezing. Temperatures in the old cellar accordingly ranged from 29° F. to 35° F. during the cold winter months, affording a contrast with the temperature of 38-40° F. maintained in the remaining experimental rooms.

The arrangement of the storage rooms was as follows, (Refer to Figure 1.)

Room No.	Size	Equipment	Air Changes Per Hour
1	11x11x10′ high	Bin 1, 4′x6′x8′ high, Room for crates and bags.	One
2	11x11x10′ high	Bin 2, 4′x6′x8′ high, Room for crates and bags.	Two
3	11x11x10′ high	Bin 3, 4′x6′x8′ high, Room for crates and bags.	Three
4	15x 9x10′ high	Bin 4, 5′x5′x8′ high, 5, 5′x5′x6′ ″ 6, 5′x5′x3′ ″ 7, 5′x5′x3′ ″ (Bin 6 being built directly above Bin 7 with 12″ air space between) Room for crates and bags.	Four
5	35x 9x12′ high	Bin 8, 5′x5′x8′ high 9, 5′x5′x8′ ″ 10, 5′x5′x8′ ″ 11, 5′x5′x8′ ″ 12, 5′x5′x8′ ″ 13, 5′x5′x8′ ″ Room for crates and bags.	No Ventilation
6	Old storage cellar typifying storage under farm conditions.	Bin 14, 5′x5′x8′ high, Room for crates and bags.	No Ventilation
7	Main laboratory cellar.	Crates only stored.	Full ventilation but no stated air change

In storage rooms 1 to 5 inclusive, and in the Laboratory cellar, a temperature of 38° F. to 40° F. was maintained thruout the storage season. No attempt was made to control the humidity of the storage rooms. The temperature and humidity were recorded on Friez Hygrothermographs stationed in the various storage rooms. These instruments were checked once a week, as to temperature, by comparison with a standard mercury thermometer; and as to humidity, with a sling psychrometer. The amount of air change in the rooms with ventilation was checked by an anemometer.

DISTRIBUTION OF STOCK IN THE STORAGE ROOMS

Storge Room 1	One air change per hour.
Bin 1	150 bushels Potter County Russet Rural, immature,
Crate	10 bushels Potter County Russet Rural, immature,
Storage	2 bushels Russet Rural, mature,
	2 bushels White Rural, (Sir Walter Raleigh) mature,
	2 bushels Michigan Russet Rural,
	2 bushels Green Mountain,
	2 bushels Irish Cobbler.
Bag	5 bushels Potter County Russet Rural, immature,
Storage	1 bushel Russet Rural, mature,
	1 bushel White Rural, (Sir Walter Raleigh), mature,
	1 bushel Michigen Russet Rural,
	1 bushel Green Mountain,
	1 bushel Irish Cobbler.
Storage Room 2	Two air changes per hour.
Bin 2	150 bushels Potter County Russet Rural, immature.
	Crates and bags same as Room 1.
Storage Room 3	Three air changes per hour.
Bin 3	150 bushels Potter County Russet Rural, immature.
	Crates and bags same as Room 1.
Storage Room 4	Four air changes per hour.
Bin 4	One 8 ft. bin, containing approximately 150 bushels. Potter County Russet Rural, immature.
Bin 5	One 6 ft. bin, containing approximately 113 bushels. Potter County Russet Rural, immature.
Bins 6 and 7	Two 3 ft. bins, each containing approximately 52 bushels Potter County Russet Rural, immature.
	Crates and bags same as Room 1.
Storage Room 5	No air change. No ventilation except through opening and closing of door.
Bin 8	150 bushels Potter County Russet Rural, immature,
Bin 9	150 bushels White Rural (Sir Walter Raleigh),
Bin 10	120 bushels Irish Cobbler (bin not full),
Bin 11	150 bushels Bradford County Russet Rural, mature,
Bin 12	150 bushels Green Mountain,
Bin 13	150 bushels Michigan Russet Rural.
	Crates and bags same as Room 1.
Storage Room 6 (Old Cellar)	No regular ventilation, except when door was open.
Bin 14	150 bushels Potter County Russet Rural, immature,
Crates	5 bushels Potter County Russet Rural.
Storage Room 7	Main Laboratory cellar. Full ventilation thru cellar door when outside temperature permitted the opening of the door; at other times four air changes per hour.
Crates	A number of crates of each of the varieties.

MOVEMENT OF POTTER COUNTY STOCK INTO STORAGE

Potter County Russet Rurals were shipped October 22, 1924, loaded in two box cars, the doors of which were left partly open. Three days were required for freight delivery to Canton. Upon arrival at Canton they were at once trucked to the Laboratory storage, where they were put in the various storage rooms in bins, crates and bags, as rapidly as possible, storage being completed October 28, 1924. This stock was planted June 15, 1924. Vines were killed by frost about September 23. Digging commenced Saturday, October 18, and was completed Tuesday, October 21. The tubers had not ripened. They were very green. The stock was hurried to the sorting table at the Potter Co-Operative Potato Warehouse as rapidly as dug, sorted and loaded on the car in crates the same day the sorting was completed. Of the first car approximately 33 1-3% was sorted out before shipment; of the second car, approximately 15%. Stock proved to have some field frost. It was an average grade of Potter County stock. Ventilation in transit was thru a partially open door. Sweating was very profuse, owing to the immature condition of the skin. The potatoes, while dry on the outside of the crates, were very sweaty within as delivered to the Laboratory from the car. It was noted that despite the care taken to ship in crates and to keep the car door open in transit, sufficient heat and moisture had developed to cause some rot. There was a rotten potato in the middle of probably 75% of the 1,200 crates received.

In placing the stock in the various storage rooms, all rotten stock detected was thrown out, but the potatoes were not re-sorted. The tubers were sweating profusely, the surface being as a rule entirely wet.

MOVEMENT OF OTHER STOCK INTO STORAGE

The Bradford County stock, including the Russet Rural, mature, White Rural (Sir Walter Raleigh) and Irish Cobblers, were moved to the storage in trucks about the same time as the Potter County stock, and were dry when received. The Green Mountains were received by car from the southern part of the state in November, 1924, being shipped in bags. The Michigan Russet Rurals were received early in December, 1924, having been moved by car from Michigan to Towanda, Pa., and by truck from Towanda to the Laboratory.

REPORTS OF CONDITION OF STOCK

A report of the condition of the stock involved in this investigation was made on November 12, 13 and 14, 1924, by representatives of the Bureau of Plant Industry, Pennsylvania Department of Agriculture. Succeeding reports on the condition were made on the following dates:

December 10, 1924,
January 12, 1925,
January 28, 1925,
February 16, 1925,
March 2, 1925,
March 17, 1925,
March 30, 1925,
April 13, 1925.

A detailed report of the condition of the potatoes when storage was broken was made from April 28 to May 5, 1925.

The report of the condition of the stock when received into storage and of the condition of the stock when storage was broken appears as Section II of this Report.

PLAN OF EXPERIMENTAL WORK

It was thought that information regarding storage changes, such as the occurrence of rot, sweating, etc., might be obtained from a study of the temperature within the bins. For the purpose of this study it was desirable to make weekly records of the temperature of each cubic foot of bin storage.

To accomplish this the "Temperature Gun", shown in Figure 2, was devised. This gun was built of wood, so as to be non-conducting. It was used to obtain penetration into the bin from front to back. As many guns were used as were required by the surface measure of the bin. For the bins six feet wide by eight feet high, forty-eight guns were used, placed in rows one foot apart, and stationed in the row one

foot from center to center. The different lengths of the barrels extending into the bin enabled the desired number of temperature records to be obtained. For the bins four feet deep, three barrels were used; for the bins five feet deep, four barrels. The bore of the barrels was of suitable size to enable a mercury thermometer to be inserted within it. The metal guard at the end of each barrel provided an open space just beyond the barrel into which the thermometer could be pushed by a wooden push rod. A string attached to the thermometer permitted withdrawal. The opening in the outer end of the thermometer guns were closed with corks, except when temperature was being recorded.

In each of the three bins 4x6x8′ high there were 105 thermometer stations, while in each of the bins 5x5x8′ high, there were 112 thermometer stations. The total number of thermometer stations was 1370. One observer was employed continuously thruout the storage period in recording the temperature within the bins, a complete round being made each week.

A sample of the weekly records thus obtained is given in Appendix A.

TEMPERATURE WITHIN THE BINS

It was quickly found that there was a rise in temperature from the bottom to the top of the bins, and that the temperature increased from the front to the back of the bins. The difference was not the same for the different bins and varied from week to week. Figure 3 shows the difference between the average temperature at the bottom of the bin and the average temperature at the top of the bin, a separate record being made of these temperature differences in each bin.

It is to be noted that in the temperature record of each of the bins, there are in general three characteristic divisions:

1. A decline in temperature difference at the beginning of the storage when the tubers were settling down into the storage period.
2. A relatively uniform temperature difference during the middle of the storage period.

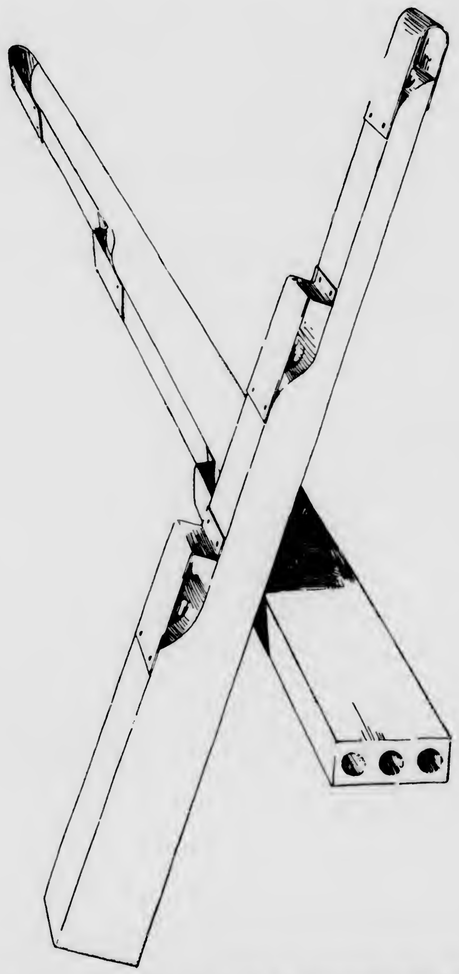

FIG 2. "Temperature Gun" used in determining the temperature of the potatoes stored in bins.

3. An increase of temperature difference toward the end of the storage period, corresponding to the time of germination (The high reading in Bin No. 14 of week No. 15 was caused by opening the doors of the storage room in the middle of the day.)

The cause of these temperature differences is the heat occasioned by the respiration of the potatoes. Appleman (1) states:

"The process of respiration produces heat. The heating of potatoes in large heaps or bins is due to rather high respiration and poor ventilation, making it impossible for the produced heat to escape. As this heat accumulates and warms the atmosphere surrounding the tuber it accelerates the very process which produces it."

Barrott (6) states:

"All fruit and vegetables during the life period, which not only includes the period of growth but the period of storage till decay sets in, constantly eliminates heat in amounts peculiar to that particular produce. This heat is due to life processes and is accompanied by an elimination of carbon dioxide gas and an absorption of oxygen. You can readily see, therefore, that with any produce stored in a bin the material on top would act as a heat insulator to material farther down in the bin, preventing the escape of the heat generated in the life processes and thereby this heat not being able to escape, would gradually raise the temperature of the produce. In some cases where the material packs very closely (like some grains) the insulating properties are so good that the temperature of the grains will gradually increase till actual scorching takes place."

The heat resulting from the normal respiration of a number of fruits and vegetables has been measured by Barrott (5).

The conditions of bin storage are such that only a portion of the heat eliminated by the potatoes is retained and represented by the increase of temperature within the bin. A large portion of the heat escapes thru the front and open top of the bin. There is to be expected, therefore, no close relationship between the rise of temperature which is shown in Figure 3 and the rate of respiration. It is, however, inter-

(x) In Appendix B following this report is given a complete table of temperatures used in making the chart presented in Figure 3.

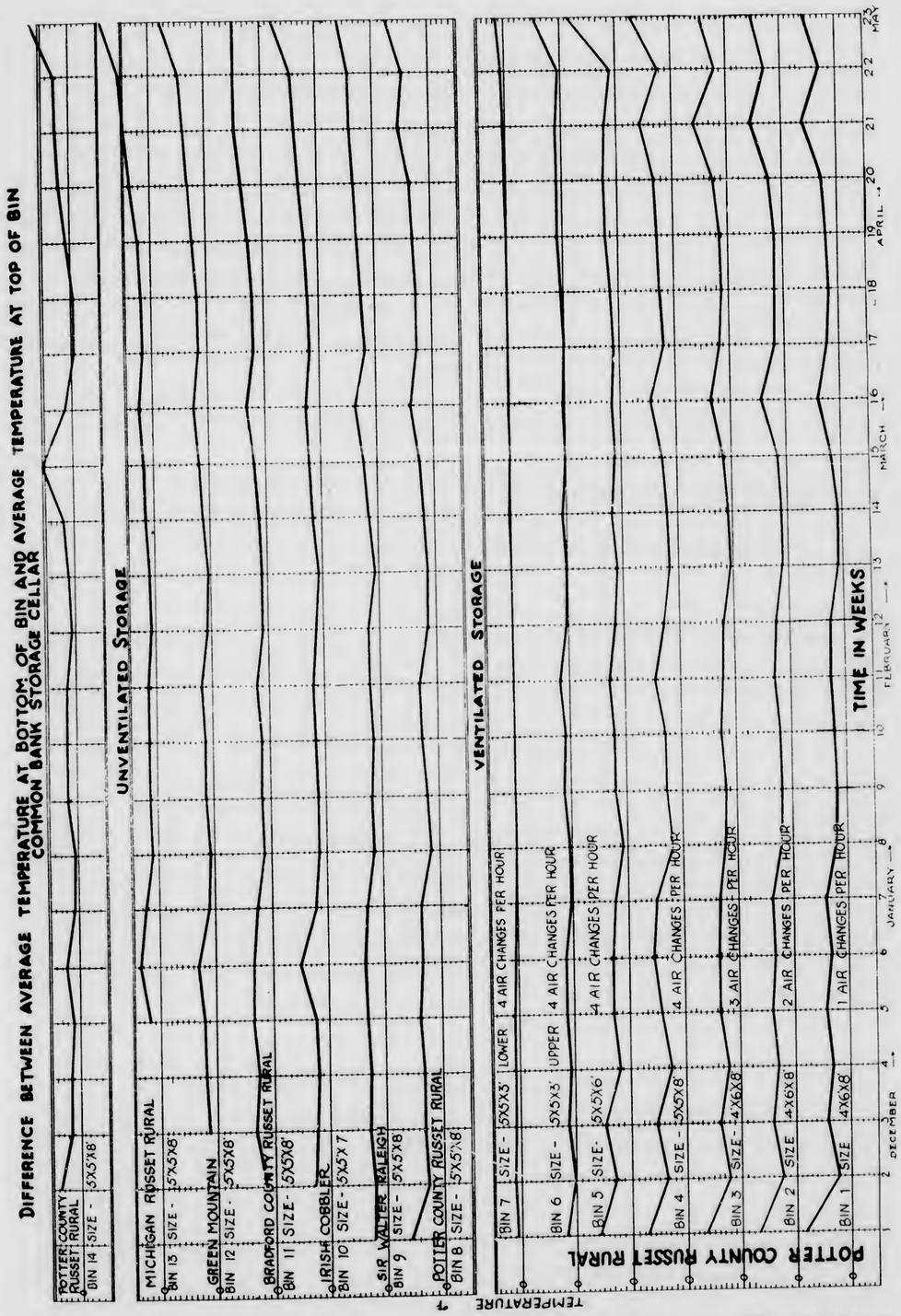

FIG. 3. This Chart shows the differences of temperatures within the bins. The difference between the heavy black line and the base line represents the number of degrees rise in temperature from the bottom to the top of the bin, readings for the separate thermometer stations in the bottom foot of the bin and in the top foot of the bin being averaged to obtain the values indicated.

esting to notice that the chart shows that as the potatoes settled down into the storage period, the heat elimination decreases; then follows a more or less steady line until the middle of February when germination started, and then slightly increases until the end of the storage period, when corresponding with the rapid growth of germination, the line turns sharply up. This is in accordance with what would be expected from Appleman's (2) report on the respiration of the potato during the three stages of storage mentioned.

THE EFFECT OF DEPTH OF BIN UPON THE RISE IN TEMPERATURE FROM BOTTOM TO TOP OF BIN

It will be noted that the temperature differences in bins 1, 2, 3 and 4 stationed in storage rooms 1 to 4 inclusive, where air change was employed, are about the same as those in bins 8 to 13 inclusive, where there was no air change. This is because an ordinary ventilating current will not penetrate into the solid mass of potatoes in a bin, when the bin is deep. The ventilating current, following the path of least resistance, will seek escape thru the open space rather than that offered by the mass of potatoes.

In bins 1 to 4 inclusive, all eight foot bins, there are no temperature differences to indicate deeper penetration of air, despite the fact that the rate of air change increased from one change per hour in Bin 1 to four changes per hour in Bin 4.

In Bin 5, which is a 6 foot bin, the temperature difference is less, indicating that some of the ventilating air penetrated thru the bin.

In Bins 6 and 7, the two three foot bins, the very slight temperature differences, negligible in Bin 7, indicate penetration of the ventilating air in sufficient volume to carry off the heat of respiration. It is, however, to be noted that the condition of Bin 7 was much better than that of Bin 6 at the end of the storage period, as may be seen by comparison of the views of the two bins, plate IV. There is an evident advantage in the more direct action of the ventilating air upon Bin 7 due to its position directly above the air ducts.

Temperature and Humidity

		OPEN CELLAR		ROOM 1		ROOM 2		ROOM 3		ROOM 4		ROOM 5		OLD CELLAR	
	WEEKS	WEEK ENDING	T	H	T	H	T	H	T	H	T	H	T	H
	1	11-17-24	42	82	47	70	47	66	47	67	46	67	47	69	
	2	11-24-24	44	88	44	64	44	64	43	65	43.5	65	43.5	70	
	3	12-1-24	43	85	44	64	44	64	44	65	44	66	45	75	40	72
	4	12-8-24	42	87	43	65	43	64	43	65	41.5	66	43	74	38	73
	5	12-15-24	42	85	43	67	44	67	44	68	43	69	43	74	39	63
	6	12-22-24	41	86	42	68	42	68	42.5	68	41.5	71	43	75	37	63
	7	12-29-24	38	82	40	68	40	68	40	67	38	68	42	74	34.5	60
	8	1-5-25	36	84	37	68	37	68	36.5	69	35	71	39	76	33	69
	9	1-12-25	37	88	37	70	37	69	37	71	36.5	71	38.5	76	34	71
	10	1-19-25	36	86	37	68	37	68	37	69	36	74	38.5	76	33	71
	11	1-26-25	36	86	36	68	36	68	36	68	35	68	37	75	32.5	70
	12	2-2-25	34	87	34	69	34	68	33.5	69	34	70	36	74	32	68
	13	2-9-25	37	92	34	70	34	69	33.5	70	35	74	37	75	33	73
	14	2-16-25	40	92	37	71	37	70	37.5	73	39	82	40	74	37	74
	15	2-23-25	40	92	38	70	38	69	38.5	71	39.5	82	40	74	36	74
	16	3-2-25	40	90	40	72	40	70	40	73	40	80	41	74	34	60
	17	3-9-25	45	88	37	68	37	67	37	70	37	75	39	74	32	66
	18	3-16-25	48	93	39	71	39	70	39.5	69	40	82	41	75	35.5	72
	19	3-23-25	48	93	40	70	40	69	40	68	41	83	42	75	36.5	73
	20	3-30-25	46	90	42	70	42	69	42	68	43	83	44	75	38	73
	21	4-6-25	41	76	43	83	43	80	41	75	40	80	42	80	39	74
	22	4-13-25	43	75	43	78	42	75	41	75	41	85	44	82	40	76
	23	4-20-25	44	80	45	82	44	82	44	80	43	85	45	82	42	75
	24	4-27-25	48	85	48	84	48	83	48	83	48	83	48	80	48	73

FIG. 4. Chart showing the average weekly readings of temperature and humidity for the storage rooms.

THE EFFECT OF TEMPERATURE OF HOLDING UPON THE RISE OF TEMPERATURE FROM BOTTOM TO TOP OF BIN

Bins 1 to 13 inclusive were all held at a temperature of 38° to 40° F. The fact that the temperature of holding has an influence upon the rise of temperature from the bottom to the top of bin is shown in the temperature record of Bin 14. No attention was paid to the temperature of storage room 6 in which Bin 14 was located, other than to prevent freezing. The range of temperature, as shown in Figure 4, where the averages of temperature and humidity in all the storage rooms is given, is from 40° F., when storage commenced, to 31° F. in January and February, and back to 40° F. in April. (Weekly temperatures of Bin 14 are given on Plate II). A cold snap in the fifteenth week of storage threatened freezing, and the outside door was opened in the middle of the day causing the sudden rise of temperature difference noted for that week on Chart 3. Otherwise no effort was made to control the temperature of the room. It was expected, in view of the findings of Hopkins (3) and Bennett and Bartholomew (4) to the effect that the rate of respiration of storage tubers increases from 38° F. to 32° F. reaching a maximum at 32° F. that the temperature difference in Bin 14 would be much greater than in Bins 1 and 13 inclusive. But the differences are less, despite the depth of the bin and the fact that there was no air change. The potatoes stored in Bin 14 were in nearly as dormant condition at the breaking up of storage on May 1, 1925, as those in Bins 6 and 7, as is shown in Plate II and IV. This lack of correspondence between rate of respiration and rise in temperature is interesting and deserves examination.

SWEATING IN STORAGE

There are three distinct kinds of sweating:

1. The sweating of a freshly dug potato, which Appleman (1) states is due to the high rate of respiration of the tuber when dug. This sweating, which occurs in both mature and immature tubers, lasts for a number of days, but does not last for a long enough period to be harmful as a storage factor.

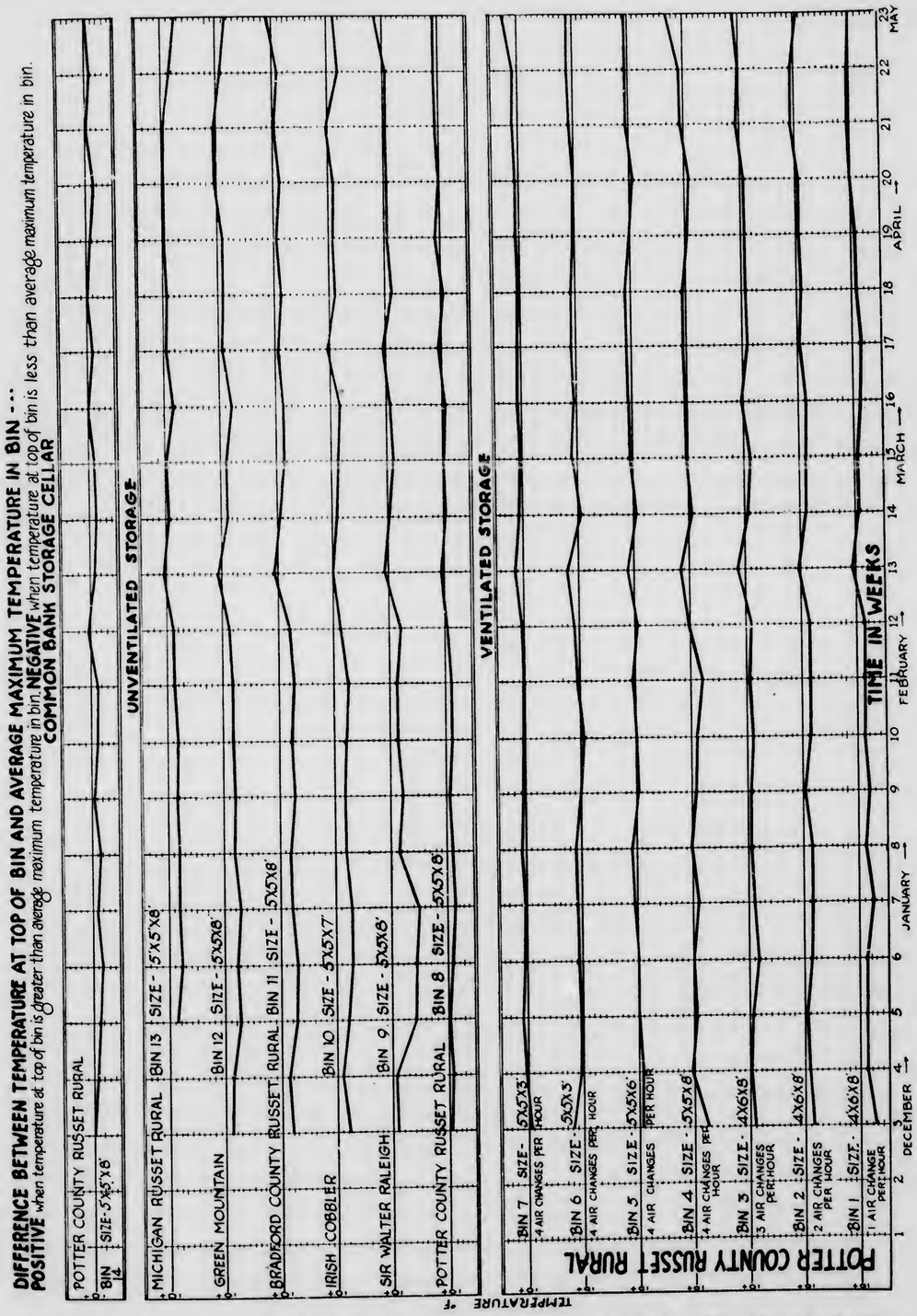

FIG. 5. Chart showing the difference between the temperature at the top of the bin and the average maximum temperature in the bin. In this Chart the base line indicates the temperature of the air directly over the bin, and the heavy black line the difference in temperature between the air in the top foot of the bin and the air over the bin. When the heavy black line is below the base line it indicates that the air above the bin is colder than the air in the bin. The scale transforms the distance between the two lines into degrees of temperature.

2. The sweating produced when potatoes which have been stored in a cold room are suddenly removed into a warmer room. The precipitation of moisture upon the cold surface of the potatoes is that which always takes place when a cold surface is brought into a warm room.

3. There is, however, another type of sweating which occurs while potatoes are in storage. It is this which is usually referred to under the term "sweating" in connection with storage. This sweating is undesirable. In our study as to its cause we discovered a relationship between the temperature of the air directly over the bin and the temperature of the top foot of potatoes in the bin. A record was accordingly made for each of the 14 bins of the temperature of the air directly above the bin and of the top foot of the potatoes in the bin, and a chart was drawn, (Fig. 5) giving the temperature differences thus obtained.

Observation established that whenever the air above the bin was colder than the air in the bin, sweating occurred; whenever the air above the bin was warmer than the air within the bin, the potatoes were dry,—no sweating took place.

The Chart (Fig. 5), therefore, represents a picture of the condition of the bins as regards sweating, the difference between the heavy black line and the base line showing the amount of sweating. Whenever this difference was more than 2° sweating was profuse, but a difference of only a fraction of a degree was sufficient to allow the sweating to take place.

The cause of storage sweating, therefore, is shown to be the natural life processes of the potato, when the potato is stored under conditions which do not admit of free escape of the heat of respiration.

The rise in temperature from the bottom to the top of the bins not only records the temperature of the potatoes, but also indicates the temperature of the air circulating thru the bins and escaping from the top of the bins. Moreover, this air is not only heated, but carries with it the moisture transpired by the potatoes as a part of the respiration process, with the result that the air rising thru the bin is nearly saturated at the bin temperature.

When the room conditions are such that the air above the bin is lower in temperature than the air rising from the bin, precipitation of the moisture carried by the bin air naturally takes place in the form of what is termed "sweat". This moisture extends down in the bin to a depth dependent upon conditions. Around the sides of the bin and in front of the bin escape of the heat of respiration takes place much more easily than towards the center of the bin, especially when the front of the bin is constructed from loose boards with cracks between the boards. Correspondingly, the sweating portion of the bin is usually in the center, with a dry portion around the front and sides.

The amount of sweating is determined by a number of factors:

1. The temperature of the storage as affecting the dew point, or the temperature at which precipitation takes place.
2. The humidity of the bin air.
3. The temperature difference between the bin air and the air above the bin.
4. Particular features of construction of the bin, especially the tightness of the sides and ends. A bin formed in part of an outside stone wall with dirt banking will act differently from a bin having a bottom consisting of a slatted floor above the real earth floor. Slight differences in construction effect the ease of escape of the heat of respiration and the humidity of the air rising from the bin.
5. Whether or not there is ventilation. The character of ventilation and the amount of ventilation make a striking difference.
6. The rate of respiration at the storage temperature of the particular variety stored. Different varieties have different rates of respiration.

These being the cause of sweating, the effect of sweating on the tubers is next to be considered.

When tubers which have undergone a prolonged period of sweating become dry thru a change in the temperature relationship, the tubers, if sound, seem to be physically uninjured by the sweat. We have not noticed a spread of rot on sound tubers due to sweat, nor have we noticed a spread of mold among sound tubers due to this cause. The amount of rot and the amount of mold is effected by the amount of moisture, but mold occurs only on tubers which have a cut or bruised skin. Mold does not penetrate a sound, unbroken skin.

The main effect of sweating is to cause earlier germination of the tubers which are wet, altho it does not increase the amount of germination present at the end of the storage term, as will be seen from a comparison of the bin stored stock in the room without ventilation

(Room 5) and the stock stored in the 8 foot bin in the room with four air changes per hour (Room 4). It seems to supply a condition favorable to growth. The degree of germination and the amount of its occurrence are influenced by the amount of sweat, the duration of the sweat, and the variety of potatoes.

Where sweating has been intermittent, germination is not so far advanced as where the potatoes have been sweating continuously.

The length of time required to cause germination differs with the variety and the storage conditions. In the unventilated bins the Department report of February 12 reports sprouts one and one-half inches long on both Potter County Russets and Bradford County Russets, but the sprouts are much more numerous on the Bradford County Russets and extended deeper in the bin.

The cure of sweating is next to be considered.

Since sweating is caused by the retention in the potatoes as stored of the heat of respiration, the logical method to cure or prevent it is to store under conditions which admit the ready escape of the heat of respiration. This involves storing in small amounts with opportunity for escape of heat on all sides of the stored produce. Crates or bags piled with ample dunnage comply with these requirements. Either package allows free escape of heat of respiration. Crates are to be preferred to bags, both because they allow freer escape of the heat of respiration and because they do not absorb the moisture given off. Bags have a distinct tendency to become wet and must be carefully handled with plenty of ventilation.

A moderate amount of ventilation is of assistance in all types of potato storage to carry off the heat and other products of respiration.

A second method is storing in bins sufficiently shallow to permit ventilation introduced from below to carry away the heat of respiration and keep the temperature conditions thru the bins uniform. Such conditions are found in the 3 foot bins, with four changes of air per hour. (Room 4).

A third method is keeping the temperature of the air above the bins warmer than the air issuing from the bins, so that the moisture

laden air can escape without depositing its moisture. Such a condition is present in the 8 foot bin with four changes of air per hour. (Room 4).

The potato sweating discussed herein is sweating of potatoes in bins during storage. It is not to be confused with the sweating of potatoes directly after digging, especially the sweating of immature seed. Immature seed requires special treatment to harden the skin and dry the potatoes off before placing them in storage.

TEMPERATURE OF ROTTEN POTATOES

In the course of our investigation we made a study of individual potatoes on the top of the bins, and established some interesting facts. The potato responds quickly to the temperature of any object with which it is in contact. The weight of a glass tube mercury thermometer made a distinct difference in the reading, hence in taking the readings care was taken to insert the thermometer vertically so that the thermometer tube would not rest on the potatoes. It was found that when a potato is held between the thumb and forefinger for two or three minutes, the temperature of the potato rises perceptibly, quickly reaching a difference of one-half a degree and sometimes showing a difference of as high as 2°. There appeared, however, to be no difference between the temperature of rotten potatoes and sound potatoes. This observation is based upon repeated tests of potatoes showing storage rots of all of the types which appeared in our storage season.

VENTILATION

That ventilation is an important factor in delaying germination has been shown by Stuart (7).

Ventilation, as discussed in this Report, is synonymous with the phrase "moving air". No attempt has been made to distinguish between the effect of fresh outside air and recirculated air. In our experimental work, fresh outside air alone has been used. No attempt has been made to control the temperature or the humidity of the ventilation air, other than taking the air used in forced draft circulation from rooms where the air was somewhat tempered in cold weather, so that there would be no danger of freezing the tubers.

In referring to the character of ventilation of the Laboratory cellar, the term "full ventilation" or "unrestricted ventilation" is used to indicate that the amount of ventilation was not measured or controlled, but was such as would naturally take place in a bank cellar storage where potatoes are stored near the outside door. The outside door is, under our practice, kept open whenever temperature conditions permit. It is open thruout the day and night, and is open in the fall and early winter until the outside temperature reaches 20°. The amount of air change thus indicated varies from one change to twenty or more changes per hour. Sometimes there is a definite breeze; at other times the air is still.

In the case of potatoes stored in rooms having a definite air change per hour, the ventilating air was introduced into the bottom of the room and allowed to pass out thru the top of the storage room. Metal ducts terminating in 4″ openings capped with mushroom shaped deflectors were used to distribute the air uniformly in the storage rooms. The amount of air change was measured by an anemometer. In determining the amount of air required to produce one air change per hour, allowance was made for the space occupied by the produce stored within the rooms, and only an amount of air corresponding to that of the free air space was introduced.

Thruout our work it has been recognized that, while it is possible to produce a definite air change in a storage room, it is not possible to

determine how much air movement actually takes place around the potatoes stored in containers placed in the room. In an open package, such as a slatted crate, considerable air change undoubtedly takes place. When the potatoes are stored in bins, however, it is evident that the amount of air movement within the bin varies with the depth of the bin and the size of potatoes stored in the bin. Potatoes as stored in bins produce such a closely packed mass that there is little air movement within the bin, the air seeking an easier channel of escape. Since in all of our storage rooms the slatted floor extended over the entire room, and was not limited to the space directly under the bin, a free channel of escape for the air was provided, other than thru the bin. These conditions are met in commercial storage and hence were considered without objection in our experimental work.

In our study of the effects of ventilation, therefore, it seemed important to carry on one set of determinations under experimental conditions, where the amount of air actually passing over or thru the potatoes could be varied as desired but at all times actually recorded, in addition to the work being carried on in the experimental rooms, where there was a specified air change within the room but no means of determining how much air actually came in contact with the stored potatoes.

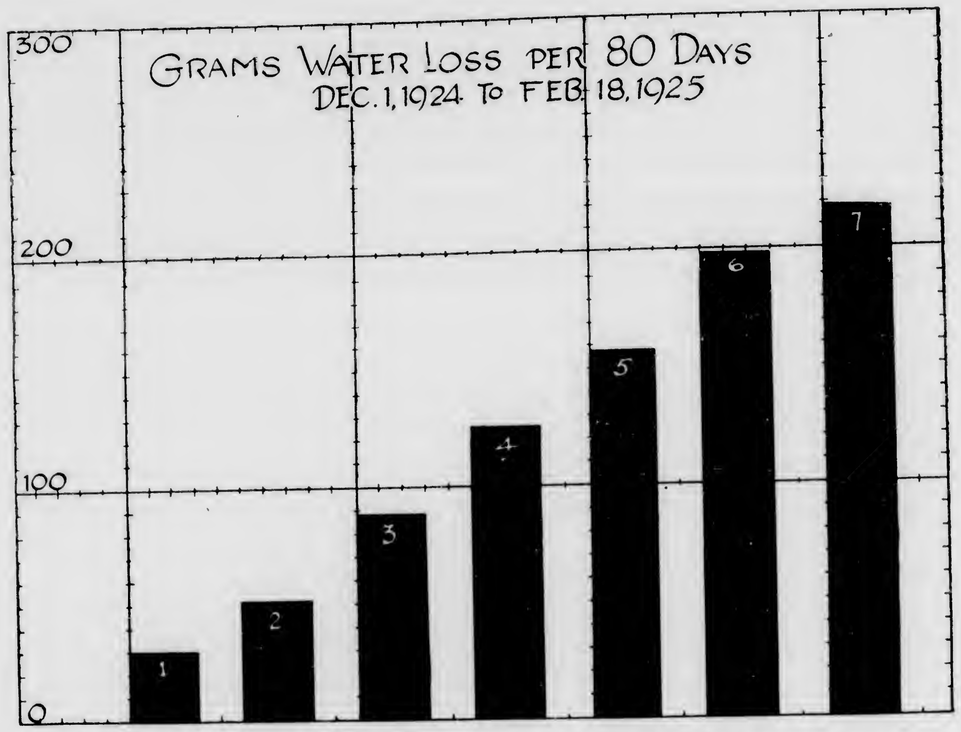

FIG. 6. Water loss in the storage of Russet Rural immature potatoes from Dec. 1, 1924, to Feb. 18, 1925, at various different rates of air change per hour:

1. One air change per 24 hours.
2. One air change per 12 hours.
3. One air change per 6 hours.
4. One air change per hour.
5. Two air changes per hour.
6. Three air changes per hour.
7. Four air changes per hour.

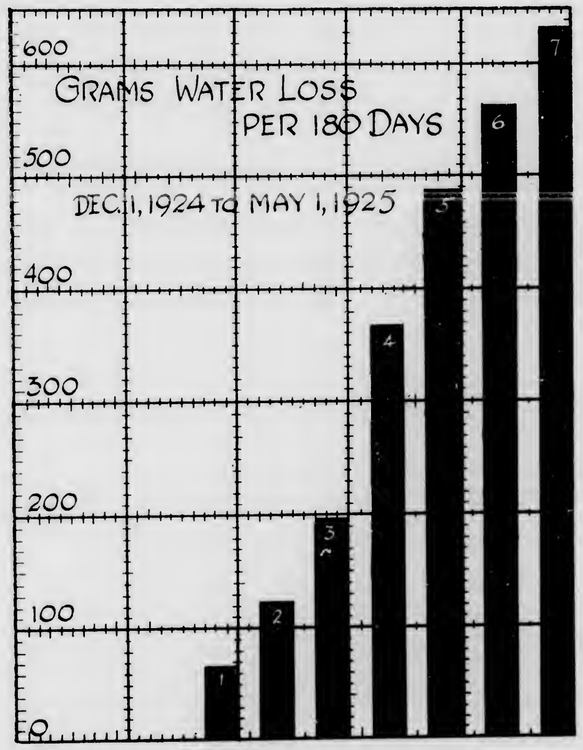

FIG. 7. Water loss in the storage of Russet Rural immature potatoes from Dec. 1, 1924 to May 1, 1925, at various different rates of air change per hour:

1. One air change per 24 hours.
2. One air change per 12 hours.
3. One air change per 6 hours.
4. One air change per hour.
5. Two air changes per hour.
6. Three air changes per hour.
7. Four air changes per hour.

STUDY OF VENTILATION OF POTATOES HELD IN CLOSED DESICCATORS WHICH PERMIT MEASURING THE AMOUNT OF AIR ACTUALLY PASSED OVER OR THRU THE POTATOES

The storage room in which this work was conducted was held at a uniform temperature of 49° F. Twelve desiccators were used. The rate of air change varied from one change per twenty-four hours to four changes per hour. The potatoes used were washed and weighed to an exact uniform weight of four kilograms, before placing in the desiccators. The air change was effected by an air suction line connected to the desiccators. The air passing thru the desiccators was dried by first being drawn thru tubes filled with calcium chloride. The amount of moisture absorbed by the air in passing thru the desiccators was collected in a second series of calcium chloride tubes and weighed.

The experiment was started December 1, 1924, and continued until the breaking up of storage May 1, 1925. The varieties used and the air changes are given in the following table:

Number	Variety	Air Change
2	Irish Cobbler,	1 per 24 hours
8	Green Mountain,	1 per 24 hours
9	Sir Walter Raleigh,	1 per 24 hours
10	Michigan Russet Rural,	1 per 24 hours
3	Bradford County Russet Rural,	1 per 24 hours
1	Potter County Russet Rural,	1 per 24 hours
4	Potter County Russet Rural,	1 per 12 hours
5	Potter County Russet Rural,	1 per 6 hours
6	Potter County Russet Rural,	1 per hour
7	Potter County Russet Rural,	2 per hour
13	Potter County Russet Rural,	3 per hour
14	Potter County Russet Rural,	4 per hour

Observations were made on the amount of moisture loss as affected by the variation in rate of air change, and upon the date of germination.

MOISTURE LOSS

Under the conditions of this experiment, only the Russet Rural immature was subjected to different rates of air change. The moisture loss which took place from December 1, 1924, to February 18, 1925, or a term of 80 days, and also that from December 1, 1924 to May 1, 1925, or a term of 180 days, as here reported:

TABLE I

Potter County Russet Rural, Immature

	Grams water loss per 80 days Dec. 1, 1924 to Feb. 18, 1925	Grams water loss per 180 days Dec. 1, 1924 to May 1, 1925
1 air change per 24 hours,	32.0693	65.7645
1 air change per 12 hours,	50.9708	122.7041
1 air change per 6 hours,	88.4746	197.0247
1 air change per hour,	124.9556	366.3046
2 air changes per hour,	157.5536	486.9036
3 air changes per hour,	197.8415	562.2336
4 air changes per hour,	229.7333	631.4633

In Figures 6 and 7 the moisture losses thus recorded are presented in the form of charts.

The reason for dividing the moisture loss into two periods is that about February 18, germination started in certain of the desiccators.

The results show that up to the time when germination started the water loss was proportional to the amount of air change. Germination is a definite factor in the amount of water loss. After germination started the amount of water loss varied not only with the rate of air change, but also with the amount of germination.

This work, unfortunately, was not started at the time of digging and covers only one variety. Further work is in progress to make a complete record from time of digging thruout the storage period, and covering a number of varieties.

While it is shown that the amount of water loss is proportional to the amount of air change, the amount of water loss sufficient to cause shriveling has not been ascertained. Under actual storage conditions, shriveling did not take place in Green Mountain, Irish Cobbler and Triumph potatoes stored in the Laboratory cellar in crates under full ventilation (Plate VI). Germination started about May 15, but at that time no shriveling, softening or wrinkling of the skin had developed.

DATE OF GERMINATION

There was a marked difference in the date of germination of the potatoes as affected by the rate of air change.

TABLE II

Showing the date of Germination of Potatoes held in desiccators under different rates of air change.
Date Experiment started, December 1, 1924.

Average Room Temperature, 49° F.

Desiccator	Variety	Air Change	Date Germination
2	Irish Cobbler,	1 per 24 hours	1-29-25
8	Green Mountain,	1 per 24 hours	3- 7-25
9	Sir Walter Raleigh,	1 per 24 hours	3- 2-25
10	Michigan Russet Rural,	1 per 24 hours	2-12-25
3	Bradford County Russet Rural,	1 per 24 hours	1-29-25
1	Potter County Russet Rural,	1 per 24 hours	2-25-25
4	Potter County Russet Rural,	1 per 12 hours	2-21-25
5	Potter County Russet Rural,	1 per 6 hours	2-25-25
6	Potter County Russet Rural,	1 per hour	2-25-25
7	Potter County Russet Rural,	2 per hour	3- 7-25
13	Potter County Russet Rural,	3 per hour	3-12-25
14	Potter County Russet Rural,	4 per hour	3-25-25

In the desiccators with two air changes per hour or less, the surface of the desiccators was clouded with moisture. The air change was not sufficient to remove the moisture produced. In the desiccators with three and four air changes per hour the glass was bright indicating that the moisture was completely removed.

DATES OF GERMINATION OF POTATOES AS AFFECTED BY HOLDING CONDITIONS

In the work reported above, the holding conditions were uniform except as to the rate of ventilation, and the influence of ventilation as a factor in delaying germination has been clearly shown. That there are other factors entering into delay in germination, however, is

shown by a review of the condition of the potatoes in the various storage rooms at the time of breaking up of storage on May 1.

In tables 4 to 9 inclusive are given dates of germination for all of the different lots of potatoes involved in this experiment, arranged by variety. The date of earliest sprouting and latest sprouting for each variety, with the type of storage involved, is given in the following table:

TABLE III

Date of Germination as Affected By Holding Conditions

Variety	Date	Method Stored	Where Stored
Potter County Russet Rural,			
Earliest Sprouts,	1-29-25	Bin	Rooms 2 & 3
Latest Sprouts,	5- 5-25	Crates	Open cellar
Bradford County Russet Rural,			
Earliest Sprouts,	1- 8 25	Bin	Room 5
Latest Sprouts,	4- 8-25	Crates	Rooms 1, 2 & 3
		Bags	and Open Cellar
Michigan Russet Rural,			
Earliest Sprouts,	1-19-25	Bin	Room 5
Latest Sprouts,	4-18-25	Crates	Open cellar
Irish Cobbler,			
Earliest Sprouts,	1-15-25	Bin	Room 5
Latest Sprouts,	5-10 25	Crates	Open cellar
Green Mountain,			
Earliest Sprouts,	1-15-25	Bin	Room 5
Latest Sprouts,	5-15-25	Crates	Open cellar
Sir Walter Raleigh,			
Earliest Sprouts,	1-19-25	Bin	Room 5
Latest Sprouts,	4- 8-25	Bags	
		Crates	Rooms 1, 2 & 3

Room 1—1 change of air per hour.
Room 2—2 changes of air per hour.
Room 3—3 changes of air per hour.
Room 5—No ventilation.

The dates of germination indicate the profound influence that method of holding in storage has upon the time of germination. In every instance, germination was earliest in bin storage and latest in crate storage. The potatoes held in crates under full ventilation in the Laboratory cellar showed the most delayed germination. The variety Sir Walter Raleigh (White Rural) was not stored in the Laboratory cellar, hence the latest date of germination given for this variety is not directly comparable.

TABLE IV
VARIETY—POTTER COUNTY RUSSET RURAL

	Date Stored	Date Sprouted	
Open Cellar,			
Crates,	11-4-24	5- 5-25	
Unventilated			
Crates,	11-4-24	3 30-25	
Bags,	11-4-24	3-30-25	
Bin,	11-4-24	2- 9-25	
One Air Change Per Hour,			
Crates,	11-4-24	4- 8-25	
Bags,	11 4-24	3-30-25	
Bins,	11-4-24	2- 9-25	
Two Air Changes Per Hour,			
Crates,	11-6-24	4- 8-25	
Bags,	11-6-24	3-30-25	
Bin,	11-6-24	1-29-25	
Three Air Changes Per Hour,			
Crates,	11-6-24	4- 8-25	
Bags,	11-6-24	3-30-25	
Bin,	11-6-24	1-29-25	
Four Air Changes Per Hour,			
Crates,	11-7-24	3-23-25	
Bags,	11-7-24	3- 7-25	
Bin 8 ft.	11-7-24	3- 7-25	
Bin 6 ft.	11-7-24	3-27-25	few
Bin 3 ft. Top	11-7-24	3-23-25	few
Desiccator 3 ft. Bottom,	11-9-24	4-11-25	few
Desiccator,			
1 Air Change per 24 Hours,	12-1-24	2-25-25	
1 Air Change per 12 Hours,	12-1-24	2-21-25	
1 Air Change per 6 Hours,	12-1-24	2-25-25	
1 Air Change per Hour,	12 1-24	2-25-25	
2 Air Changes per Hour,	12-1-24	3- 7-25	
3 Air Changes per Hour,	12-1-24	3-12-25	
4 Air Changes per Hour,	12-1-24	3 25-25	

TABLE V
VARIETY—BRADFORD COUNTY RUSSET RURAL

	Date Stored	Date Sprouted	
Open Cellar,			
Bags,	11-22-24	4- 8-25	
Unventilated Room,			
Crates,	11-22-24	3-14-25	
Bags,	11 22-24	3- 9-25	
Bin,	11-22-24	1- 8-25	where wet
One Air Change Per Hour,			
Crates,	11-22-24	4- 8-25	
Bags,	11-22-24	4- 8-25	
Two Air Changes Per Hour,			
Crates,	11-22-24	4- 8-25	
Bags,	11-22-24	4- 8-25	
Three Air Changes Per Hour,			
Crates,	11-22-24	4- 8-25	
Bags,	11-22-24	3-23-25	
Four Air Changes Per Hour,			
Crates,	11-22-24	3-23-25	
Bags,	11-22-24	3- 7-25	
Desiccator,	12- 1-24	1-29-25	

TABLE VI
VARIETY—MICHIGAN RUSSET RURAL

	Date Stored	Date Sprouted
Open Cellar,		
Crates,	12 11-24	1-19-25
Unventilated Room,		
Crates,	12-11-24	3-23-25
Bags,	12-11-24	3-23-25
Bin,	12-11-24	1-19-25
One Air Change Per Hour,		
Crates,	12-11-24	4- 8-25
Bags,	12-11-24	4- 8-25
Two Air Changes Per Hour,		
Crates,	12-11-24	4- 8-25
Bags,	12-11-24	3-30-25
Three Air Changes Per Hour,		
Crates,	12-11-24	4- 8-25
Bags,	12-11-24	4- 8-25
Four Air Changes Per Hour,		
Crates,	12-11-24	3-23-25
Bags,	12-11-24	3- 7-25
Desiccator,	12- 1-24	2-12-25

TABLE VII
VARIETY—SIR WALTER RALEIGH

	Date Stored	Date Sprouted
Open Cellar,		
Bags,	11-17-24	
Unventilated Room,		
Crates,	11-17-24	3-30-25
Bags,	11-17-24	3-23-25
Bin,	11 17-24	1-19-25
One Air Change Per Hour,		
Crates,	11-17-24	4- 8-25
Bags,	11-17-24	4- 8-25
Two Air Changes Per Hour,		
Crates,	11-17-24	4- 8-25
Bags,	11-17-24	4- 8-25
Three Air Changes Per Hour,		
Crates,	11-17-24	4- 8-25
Bags,	11-17-24	4- 8-25
Four Air Changes Per Hour,		
Crates,	11-17-24	3-23-25
Bags,	11-17-25	3-23-25
Desiccator,	12- 1-24	3- 2-25

TABLE VIII

VARIETY—IRISH COBBLER

	Date Stored	Date Sprouted	
Open Cellar,			
Crates, Home Grown,	10- 5-24	5-10-25	
Fibo-Pak, Presque Isle, Me.	10-13-24	4- 8-25	
Unventilated Room,			
Crates,	11 21-24	3-14-25	
Bags,	11-21-24	3-19-25	
Bin,	11-21-24	1-15-25	wet
One Air Change Per Hour,			
Crates,	11-21-24	3-23-25	
Bags,	11-21-24	4-13-25	
Two Air Changes Per Hour,			
Crates,	11-21-24	4- 8-25	
Bags,	11 21-24	3-30-25	
Three Air Changes Per Hour,			
Crates,	11-21-24	4- 8-25	
Bags,	11-21-24	4- 8-25	
Four Air Changes Per Hour,			
Crates,	11-21-24	3-23-25	
Bags,	11-21-24	3-23-25	
Desiccator,	12- 1-24	1-29-25	

TABLE IX

VARIETY—GREEN MOUNTAIN

	Date Stored	Date Sprouted	
Open Cellar,			
Crates, Home Grown,	10- 5-24	5-15-25	
Fibo-Pak, Presque Isle, Me.	10-13-24	4-16-25	
Bags—Bucks County,	12- 3-24	4- 3-25	
Unventilated Room,			
Crates,	12- 3-24	3-23-25	
Bags,	12- 3-24	3-19-25	
Bins,	12- 3-24	1-15-25	few
One Air Change Per Hour,			
Crates,	12- 3-24	4-16-25	few
Bags,	12- 3-24	4- 8-25	
Two Air Changes Per Hour.			
Crates,	12- 3-24	4-16-25	few
Bags,	12- 3-24	4- 8-25	
Three Air Changes Per Hour,			
Crates,	12- 3-24	4-16-25	few
Bags,	12- 3-24	4- 8-25	
Four Air Changes Per Hour,			
Crates,	12- 3-24	3-18-25	
Bags,	12- 3-24	3-10-25	
Desiccator,	12- 1-24	3- 7-25	

PHOTOGRAPHS SHOWING THE CONDITION OF THE STOCK IN THE STORAGE ROOMS AT THE TIME STORAGE WAS BROKEN MAY 1, 1925

The effect of holding conditions upon date of germination is shown by photographs taken at the time of breaking up of storage. These photographs show the condition of potatoes in each foot of each bin, from the top of the bin to the bottom of the bin, also of the stock stored in crates and bags. The condition of the stock is shown more clearly than would have been possible by the use of charts.

The speciments photographed were selected by representatives of the Pennsylvania Bureau of Plant Industry. They are fair samples of the average condition of the large number of potatoes from which the selection was made.

The specimens taken from crate and bag storage are so uniform in condition that instead of devoting a separate photograph to each variety in each of the storage rooms, composite photographs of the varieties stored in crates and also stored in bags, were taken for each of the storage rooms, the variety being named by a card on the potato.

PLATE I

EFFECT OF VENTILATION ON GERMINATION

Prior to the breaking up of storage, photographs were taken to show the condition of the bin stock on March 7, 1925, on which date sprouting was quite general in the bins in the room without ventilation. In the rooms with ventilation and in the old cellar the potatoes were still dormant. The specimens shown in the photograph were selected from the top of the bins.

The varieties shown are as follows:

No. of Bin	Variety	Character of Storage
Bin 11,	Russet Rural, mature,	Room 5—No Ventilation. 8 foot bin.
Bin 8,	Russet Rural, immature,	Room 5—No Ventilation. 8 foot bin.
Bin 12,	Green Mountain,	Room 5—No Ventilation. 8 foot bin.
Bin 4,	Russet Rural, immature,	Room 4—Four air changes per hour. 8 foot bin.
Bin 5,	Russet Rural, immature,	Room 4—Four air changes per hour. 6 foot bin.
Bin 7,	Russet Rural, immature,	Room 4—Four air changes per hour. 3 foot bin.

It will be noted that the mature Russet Rural germinated earlier than the immature stock.

At this stage of the storage, there was a marked difference between the rooms with ventilation and room without ventilation. Germination was taking place in all of the bins in the room without ventilation, dependent upon the maturity and the varietal characteristics of the stock. There was no germination in any of the bins under ventilation, nor in the potatoes stored in the old cellar at low temperature.

The potatoes stored in crates and bags were absolutely dormant in all of the storage rooms, including the room without ventilation.

Plate I—Photo 1. Russet Rural, mature, Bin 11, Room 5.
" 2. Russet Rural, immature, Bin 8, Room 5.
" 3. Green Mountain, mature, Bin 12, Room 5.

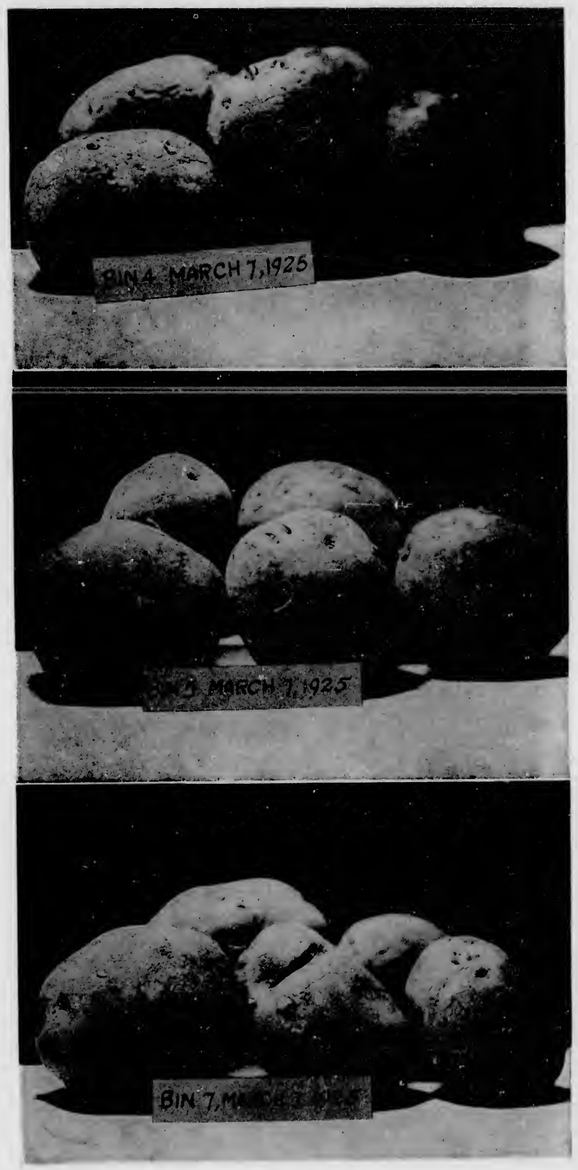

Plate I—Photo 4. Russet Rural, immature, Bin 4, Room 4.
" 5. Russet Rural, immature, Bin 5, Room 4.
" 6. Russet Rural, immature, Bin 7, Room 4.

PLATE II
EFFECT OF LOW STORAGE TEMPERATURE ON GERMINATION

While most of the experimental rooms were located in the cellar of the Laboratory building, one of the bins was located in the "Old Cellar",—a storage room 24′ long x 16′ wide x 9′ high, built underground with stone walls, concrete ceiling and concrete floor. This corresponded to holding conditions in an ordinary farm storage. No effort was made to control temperature, except to prevent freezing. Two ventilation flues with which the cellar was provided were closed. In every way it was sought to duplicate storage conditions prevailing in farm storage.

The storage room temperature ranged from 40° F. at the time storage commenced, to as low as 29° F. during the cold portion of the winter. This permitted the effect of low storage temperature upon germination to be observed.

Table 4, Weekly Temperatures in the Storage Room, and at the Top and Bottom of the Bin.

Date	Room. Temp.	Temp. Bottom of Bin	Temp. Top of Bin
December 6,	38.5	39.75	41.25
December 12,	39.5	40.	41.7
December 20,	37.	38.5	39.75
December 27,	33.	34.3	36.5
January 3,	33.	34.8	35.5
January 10,	34.	36.5	36.8
January 17,	33.	35.	36.4
January 24,	31.5	33.9	35.25
January 31,	31.	33.	34.5
February 7,	34.	34.5	35.
February 14,	36.	37.	38.
February 21,	35.	37.3	38.8
February 28,	29.	31.25	36.
March 7,	32.5	33.	34.
March 14,	36.	36.3	36.
March 21,	37.	37.8	37.3
March 28,	39.	39.25	29.5
April 4,	39.	39.75	41.5
April 10,	40.	39.85	42.1
April 17,	41.5	41.5	44.
April 27,	50.	45.4	52.5

It will be seen that during January, February and March, the period when germination usually starts in bin storage, the effect of the low temperature was to hold the potatoes dormant.

The photographs show that on April 27, sprouting was very slight. At the bottom of the bin the potatoes were absolutely dormant. Sweating was profuse during the storage, but this did not have the effect of producing germination.

The condition of this bin as to storage rot is shown in Section II.

The photographs demonstrate that one method of delaying germination in storage is low temperature. Temperature is relied on for the entire control. Satisfactory results may be obtained in either bin, crate or bag storage. Ventilation does not seem to be important in low temperature storage.

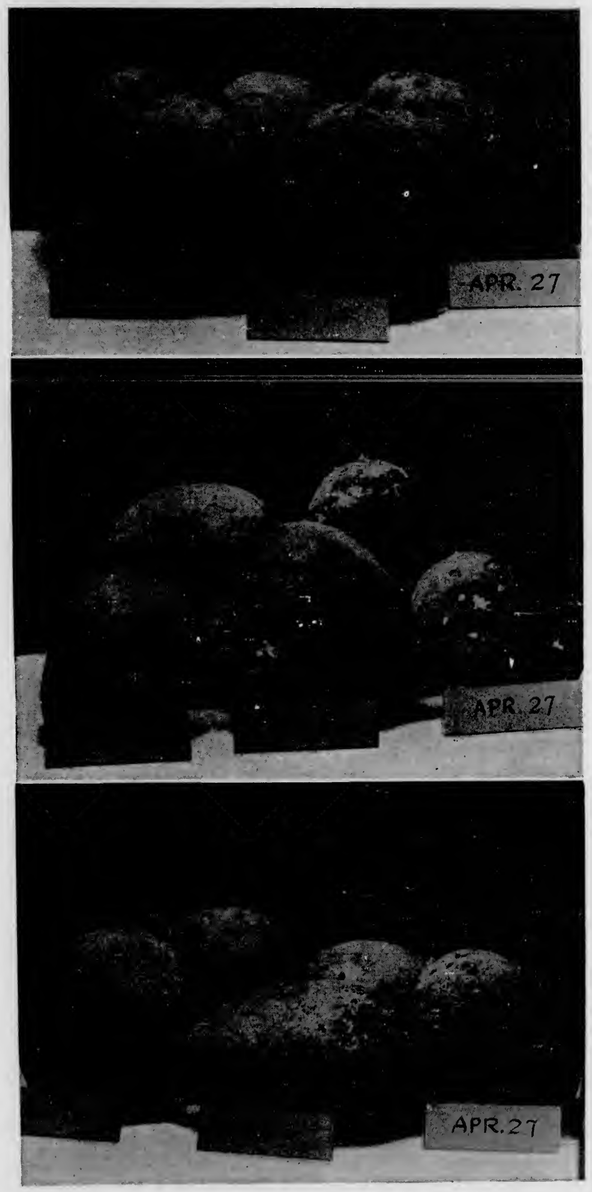

Plate II—Photo 1. Russet Rural, immature, 1st ft. Bin 14, old cellar.
" 2. Russet Rural, immature, 2nd ft. Bin 14, old cellar.
" 3. Russet Rural, immature, 3rd ft. Bin 14, old cellar.

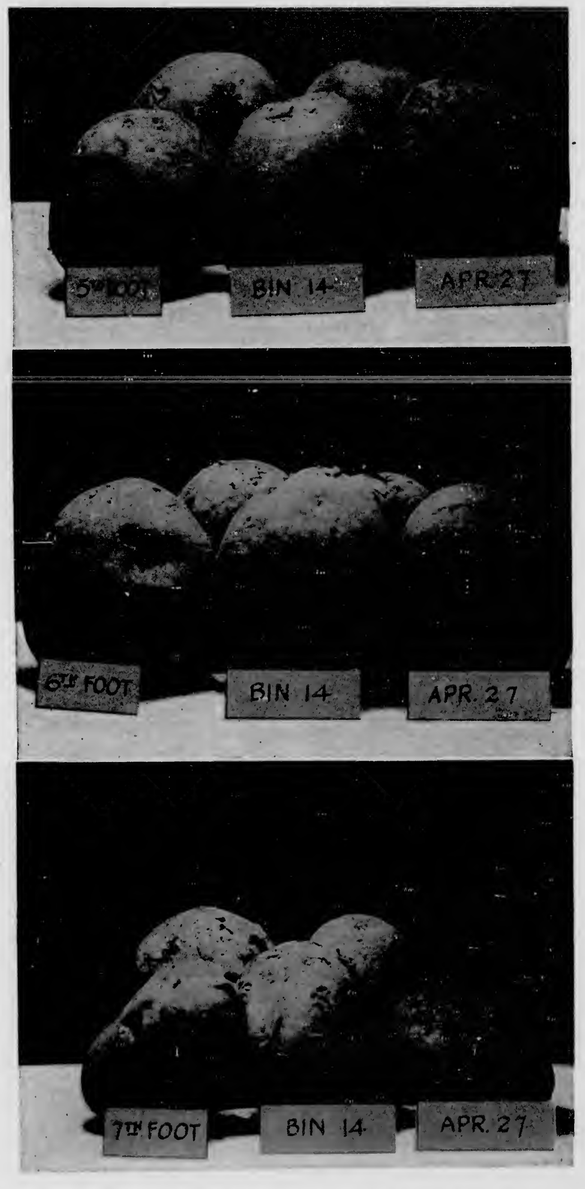

Plate II—Photo 4. Russet Rural, immature, 5th ft. Bin 14, old cellar.
" 5. Russet Rural, immature, 6th ft. Bin 14, old cellar.
" 6. Russet Rural, immature, 7th ft. Bin 14, old cellar.

PLATE III

EFFECT OF BIN STORAGE UPON GERMINATION, WHEN STORAGE TEMPERATURE IS 38-40.

Altho low temperature retards germination, there are well known disadvantages to storage at low temperatures. Not only do the potatoes become sweet because of the change from starch to sugar, but with seed potatoes the stand in the field is apt to be delayed and uneven. A temperature of 38-40° F. has been shown by Hopkins and others (2) to be the best temperature for storage. When the storage temperature is 38-40° F. the type of holding, whether bin, crate or bag storage, becomes important, as does also the absence or use of ventilation.

The photographs here presented are typical of bin storage at 38-40° F. The varieties shown are Russet Rural mature and Russet Rural immature. Germination started in bins as early as January 15, 1925, and was advanced to point of root formation when storage broke, May 1, 1925.

These varieties were stored in 8 foot bins in Room 5, the room without ventilation.

Reference to Plate I will show that on March 7, the germination on Russet Rural mature was considerably further advanced than on Russet Rural immature. This difference disappeared by May 1. The same amount of sprouting was present in both varieties.

The sprouts show the greatest development in the second and third foot from the top of the bin, and from there on there is a tendency for the sprouts to become shorter toward the bottom of the bins. Indeed, with later germinating varieties, (as will be shown in Plate V with the variety Green Mountain), the potatoes at the bottom of the bin may be completely dormant while towards the top of the bin sprouts may be profuse and well developed.

Both the Russet Rural mature and immature bins were very wet thruout the entire storage term. Sweating was profuse. That germination is not, however, directly connected with sweating is shown in Plate IV.

Plate III—Photo 1. Russet Rural, mature, 1st ft. Bin 11.
" 2. Russet Rural, mature, 2nd ft. Bin 11.
" 3. Russet Rural, mature, 3rd ft. Bin 11.

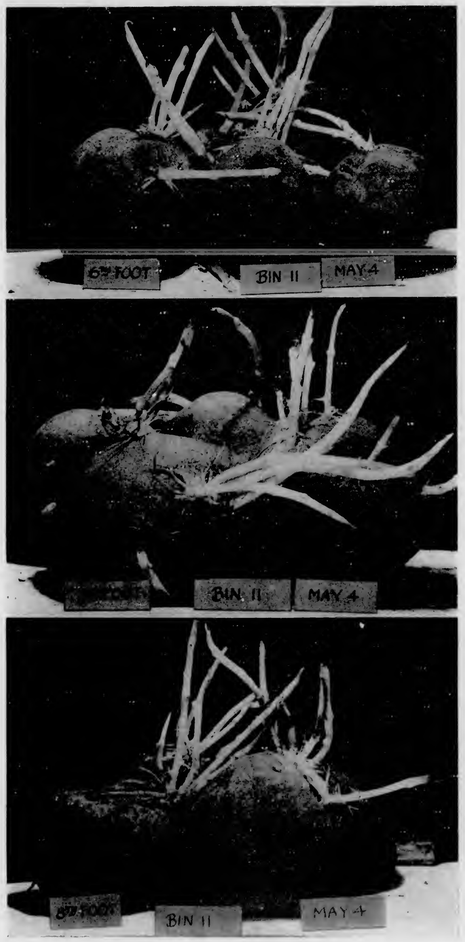

Plate III—Photo 4. Russet Rural, mature, 6th ft. Bin 11.
" 5 Russet Rural, mature, 7th ft. Bin 11.
" 6. Russet Rural, mature, 8th ft. Bin 11.

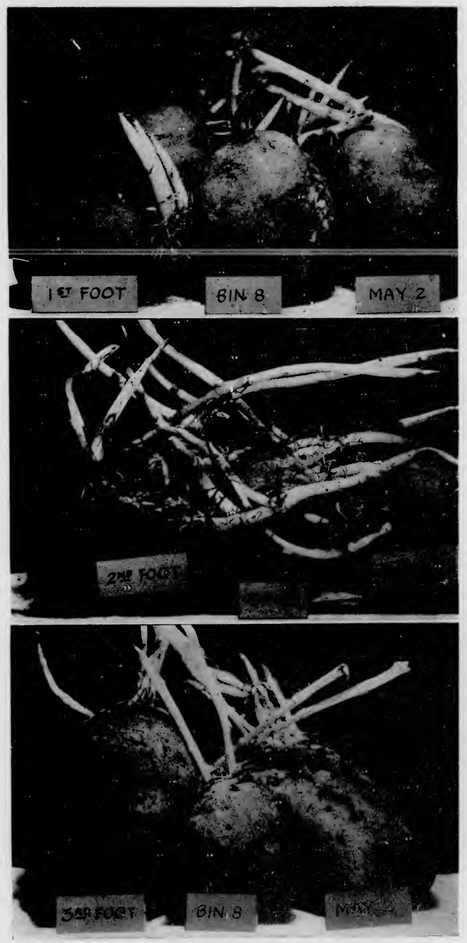

Plate III—Photo 7. Russet Rural, immature, 1st ft. Bin 8.
" 8. Russet Rural, immature, 2nd ft. Bin 8.
" 9. Russet Rural, immature, 3rd ft. Bin 8.

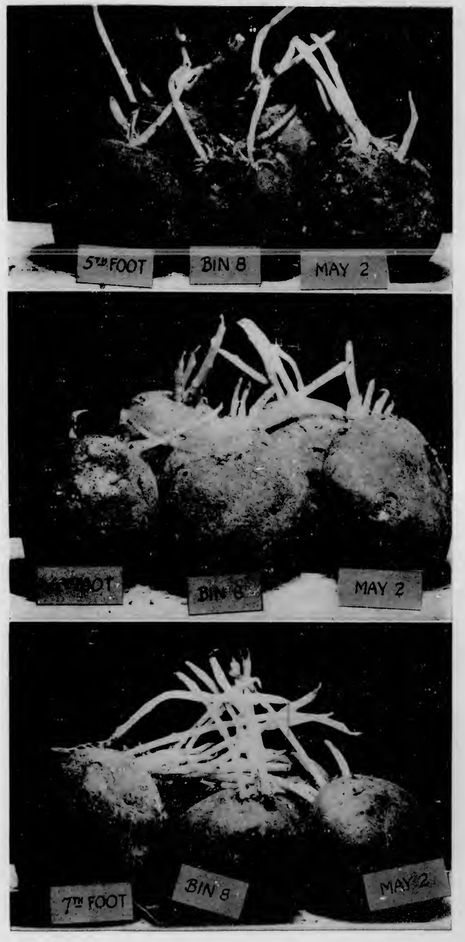

Plate III—Photo 10. Russet Rural, immature, 5th ft Bin 8.
" 11. Russet Rural, immature, 6th ft. Bin 8.
" 12. Russet Rural, immature, 7th ft. Bin 8.

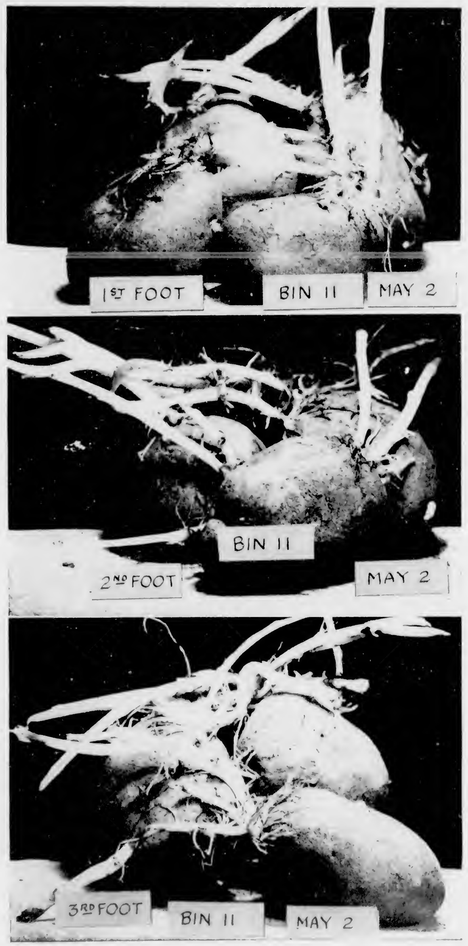

Plate III—Photo 1. Russet Rural, mature, 1st ft. Bin 11.
" 2. Russet Rural, mature, 2nd ft. Bin 11.
" 3. Russet Rural, mature, 3rd ft. Bin 11.

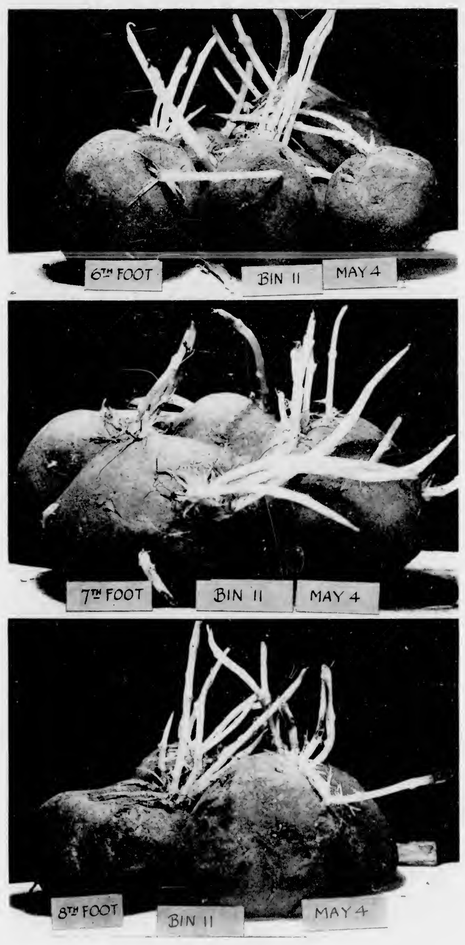

Plate III—Photo 4. Russet Rural, mature, 6th ft. Bin 11.
" 5 Russet Rural, mature, 7th ft. Bin 11.
" 6. Russet Rural, mature 8th ft. Bin 11.

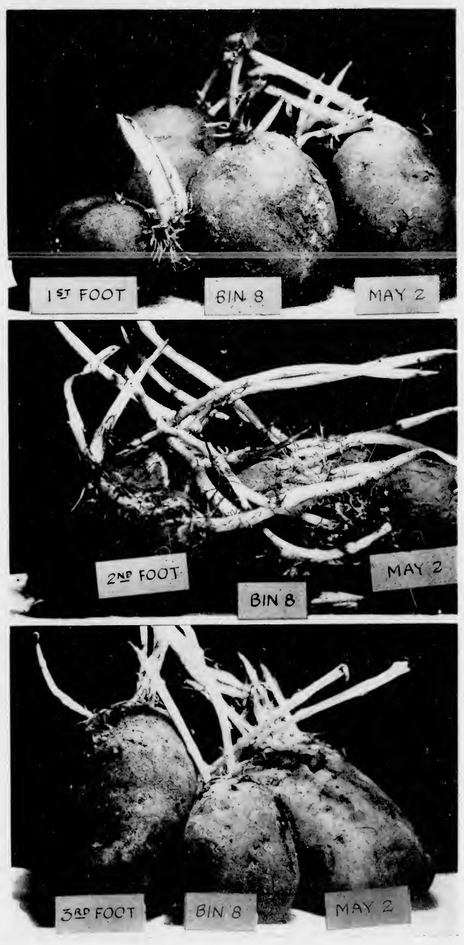

Plate III—Photo 7. Russet Rural, immature, 1st ft. Bin 8.
" 8. Russet Rural, immature, 2nd ft Bin 8.
" 9. Russet Rural, immature, 3rd ft. Bin 8.

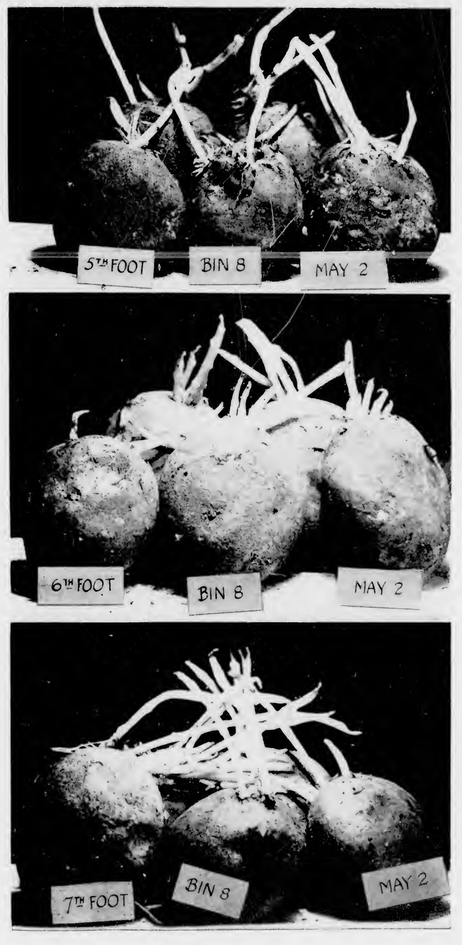

Plate III—Photo 10. Russet Rural, immature, 5th ft Bin 8.
" 11. Russet Rural, immature, 6th ft. Bin 8.
" 12. Russet Rural, immature, 7th ft. Bin 8.

INTENTIONAL SECOND EXPOSURE

PLATE IV

EFFECT ON GERMINATION OF STORAGE UNDER CONDITIONS WHICH PERMIT FREE ESCAPE OF THE PRODUCTS OF RESPIRATION, INCLUDING THE HEAT OF RESPIRATION

The photographs here shown represent storage conditions prevailing in Room 4. This was the room with four air changes per hour. The photographs show the condition of each of the four bins, also of the storage in crates and bags.

Two facts are made clear by a study of these photographs:

1. That sweating is not necessarily associated with germination.
2. That ventilation delays germination.

All of these bins were dry thruout the entire storage period.

This was especially noticeable in the 8 foot bin. It was the only 8 foot bin which was dry, and germination on the top surface of the bin was so long delayed that for a long time it was thought that this bin would be free from sprouts. When the storage was broken, however, it was found that germination was well advanced thruout the bin. Many individual specimens on the second foot from the top showed sprouts 8″ long. In fact, the longest sprouts in any of the bins were found in the 8 foot bin in Room 4.

The influence of ventilation in delaying germination is apparent by comparison of the 8 foot, the 6 foot and the two 3 foot bins. Temperature, ventilation and all storage conditions are identical in all four of these bins, and yet in the 8 foot bin sprouting was profuse, while in the lower 3 foot bin the potatoes were entirely dormant.

The reason for this difference in germination is connected with the depth of the bins. The depth of the bins regulates the action of ventilation.

With the 8 foot bins the bulk of potatoes is so great that the ventilating air only exerted an influence on the bottom of the bin. It will be noted from the photograph of the bottom foot of the 8 foot bin, that the potatoes are practically dormant.

As the bins decreased in depth, the influence of the ventilating current increased as the ventilating air penetrated more thru the bins.

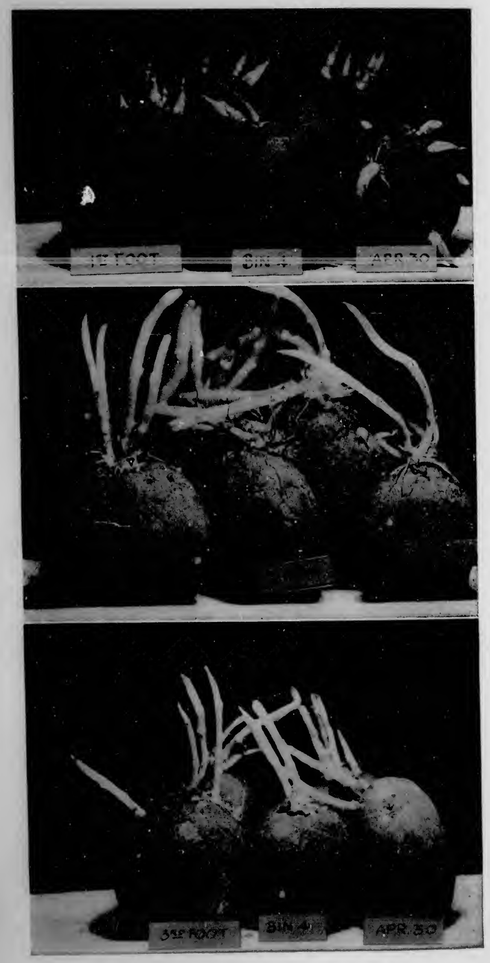

Plate IV—Photo 1. Russet Rural, mature, 1st ft. Bin 4.
" 2. Russet Rural, mature, 2nd ft. Bin 4.
" 3. Russet Rural, mature, 3rd ft. Bin 4.

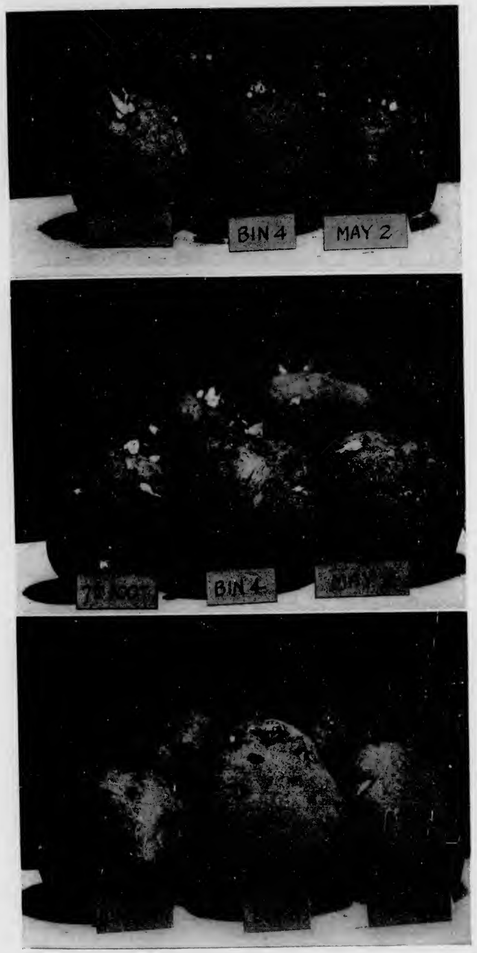

Plate IV—Photo 4. Russet Rural, mature, 6th ft. Bin 4.
" 5. Russet Rural, mature, 7th ft. Bin 4.
" 6. Russet Rural, mature, 8th ft. Bin 4.

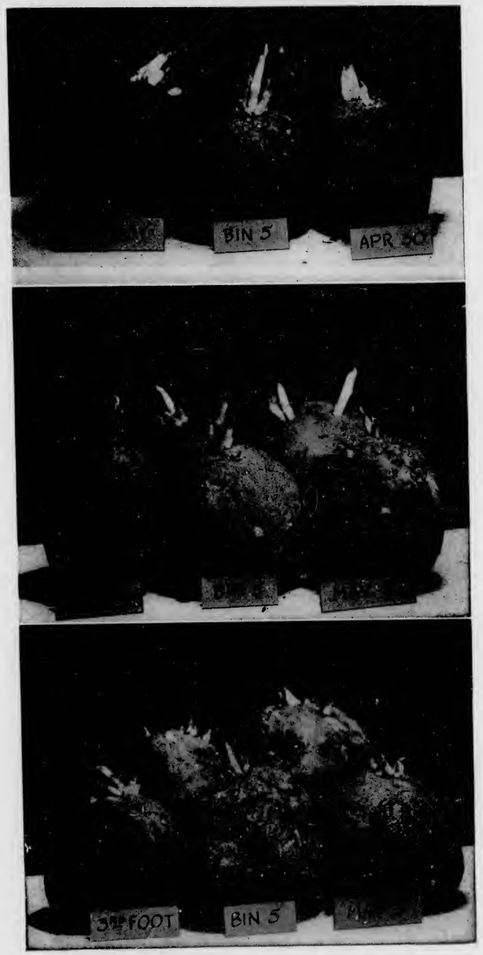

Plate IV—Photo 7. Russet Rural, mature, 1st ft. Bin 5.
" 8. Russet Rural, mature, 2nd ft. Bin 5.
" 9. Russet Rural, mature, 3rd ft. Bin 5.

Plate IV—Photo 10. Russet Rural, mature, 4th ft. Bin 5.

Plate IV—Photo 11. Russet Rural, mature, 5th ft. Bin 5.

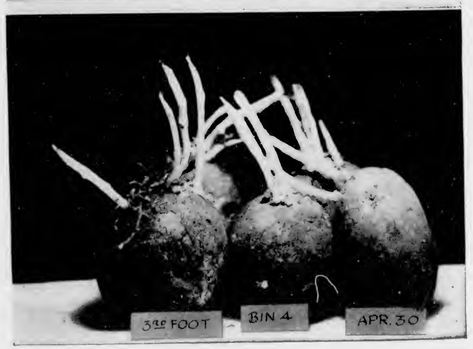

Plate IV—Photo 1. Russet Rural, mature, 1st ft. Bin 4.
" 2. Russet Rural, mature, 2nd ft. Bin 4.
" 3. Russet Rural, mature, 3rd ft. Bin 4.

Plate IV—Photo 4. Russet Rural, mature, 6th ft. Bin 4.
" 5. Russet Rural, mature, 7th ft. Bin 4.
" 6. Russet Rural, mature, 8th ft. Bin 4.

Plate IV—Photo 7. Russet Rural, mature, 1st ft. Bin 5.
" 8. Russet Rural, mature, 2nd ft. Bin 5.
" 9. Russet Rural, mature, 3rd ft. Bin 6.

Plate IV Photo 10. Russet Rural, mature, 4th ft. Bin 5.

Plate IV—Photo 11. Russet Rural, mature, 5th ft. Bin 5.

PLATE IV—Continued

In the 6 foot bin, germination was delayed in the lower foot of the bin. In the lower 3 foot bin the potatoes thruout the bin were entirely dormant.

It is, however, apparent that the action of ventilation in delaying germination is to be associated with the fact that the result of the ventilation is the removal of the entire products of respiration, including the heat of respiration. Reference to the chart shown in Figure 3, and also to the temperature table in the appendix, demonstrates that the temperature within the bins is closely associated with the action of the ventilating current.

In bin 4 there was a marked rise of temperature thru the bin; this rise was much less in bin 5 and practically disappeared in bin 7, the lower 3 foot bin.

The fact that bin 6, the upper 3 foot bin, did not show as great delay in germination as bin 7, the lower 3 foot bin, is due to the location of the bins with reference to the ventilating current. Bin 7 was directly over the ventilating outlet, whereas in bin 6 the current had to pass upward thru the 12″ distance separating the two bins and lost much of its directional force.

Under ordinary conditions of storage, bag or crate storage is to be preferred to bin storage, as either bag or crate storage affords better means for ventilation than is possible in bin storage. It is interesting to note, however, that the bags and crates stored in this room show more advanced germination than existed in the lower 3 foot bin, the reason being that both bags and crates were stored on the top of the bins, where they were removed from the influence of the ventilating current, while exposed to the higher temperature prevailing just under the room ceiling.

The bags were removed from the top of the bins and placed on the slatted floor some time in January, and certain of the varieties were absolutely dormant, while in others germination had started.

In the crate storage, however, the holding conditions were such that germination was well started in all of the varieties, clearly demonstrating that the method of holding rather than the type of package, is the controlling influence in delaying germination in storage. In this case the storage conditions were actually better in the lower 3 foot bin than in either crates or bags, and accordingly in the lower 3 foot bin we have absolute dormancy on May 1.

Plate IV—Photo 12. Russet Rural, mature, 1st ft. Bin 6.
" 13. Russet Rural, mature, middle ft. Bin 6.
" 14. Russet Rural, mature, 3rd ft. Bin 6.

Plate IV—Photo 15. Russet Rural, mature, 1st ft. Bin 7.
" 16. Russet Rural, mature, 2nd ft. Bin 7.
" 17. Russet Rural, mature, 3rd ft. Bin 7.

Plate IV—Photo 18. Composite picture of varieties stored in crates, Room. 4.

Plate IV—Photo 19. Composite picture of varieties stored in bags, Room 4.

Plate IV—Photo 12. Russet Rural, mature, 1st ft. Bin 6.
" 13. Russet Rural, mature, middle ft. Bin 6.
" 14. Russet Rural, mature, 3rd ft. Bin 6.

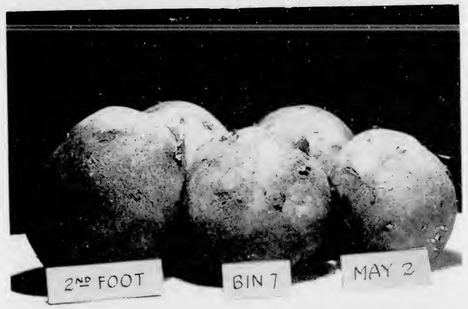

Plate IV—Photo 15. Russet Rural, mature, 1st ft. Bin 7.
" 16. Russet Rural, mature, 2nd ft. Bin 7.
" 17. Russet Rural, mature, 3rd ft. Bin 7.

Plate IV—Photo 18. Composite picture of varieties stored in crates, Room. 4.

Plate IV—Photo 19. Composite picture of varieties stored in bags, Room 4.

INTENTIONAL SECOND EXPOSURE

PLATE V

EFFECT OF TYPE OF PACKAGE ON GERMINATION

In the preceding group of photographs the effect of ventilation in causing the removal of the products of respiration, including the heat of respiration, is shown. That for this removal to take place effectively ventilation is not always necessary is apparent from the accompanying photographs, showing specimens taken from Room 5, the room without air change other than that produced by opening the door when the room was entered. The effect of type of package upon germination is here demonstrated.

The contrast between bin storage and crate or bag storage is interesting. It will be remembered that the photographs shown in Plate II present other examples of bin storage in Room 5, three of the six bins being represented in the views in Plate II and Plate V. All three bins shown, as well as the three bins not shown, are advanced in germination to about the same point, except as influenced by variety.

The variety here shown in bin storage is Green Mountain. The varieties shown in crate and bag storage are Green Mountain, Irish Cobbler, Sir Walter Raleigh (White Rural), Russet Rural mature Bradford County, Russet Rural immature Potter County, Russet Rural Michigan stock.

The views of the Green Mountain in bin storage show the typical, strong, vigorous sprouts characteristic of the variety. Germination has so far advanced that in the second and third foot roots are forming, while at the bottom of the bin the stock is nearly dormant. The germination of Green Mountain in the 8 ft. bin started January 15, 1925.

As contrasted with this, all of the varieties shown in crate and bag storage are practically dormant. The crate storage is slightly more advanced in germination than the bag storage, because the samples from the crate stored stock were taken from the top layer of crates, some four or five feet from the floor of the room, while the bag stored specimens were taken from bags piled directly on the floor of the room.

In a room without ventilation, the position of the stock in the room is an influence on germination, especially where the room is nearly full.

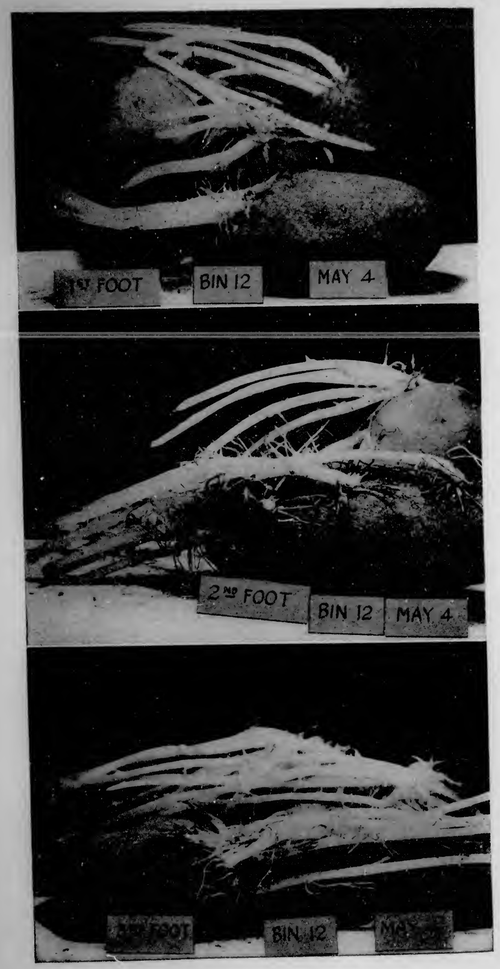

Plate V—Photo 1. Green Mountain, mature, 1st ft. Bin 12.
" 2. Green Mountain, mature, 2nd ft. Bin. 12.
" 3. Green Mountain, mature, 3rd ft. Bin 12.

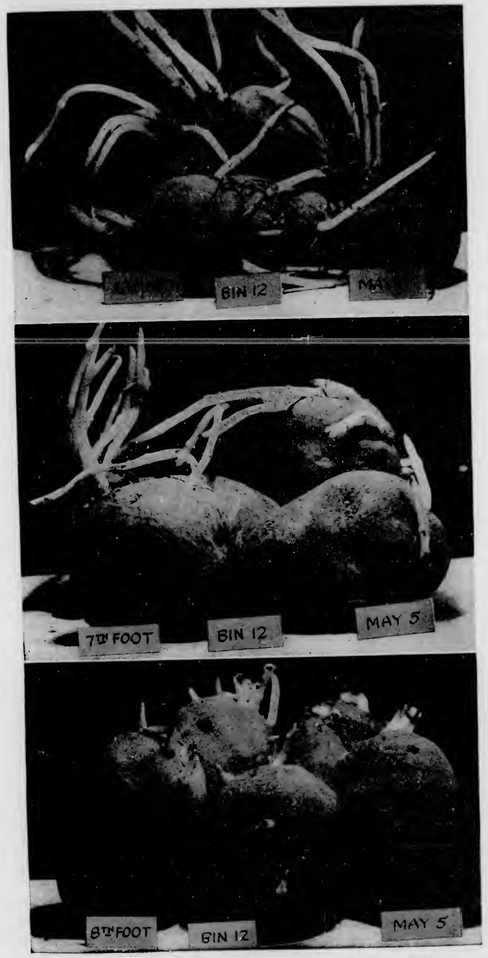

Plate V—Photo 4. Green Mountain, mature, 6th ft. Bin 12.
" 5. Green Mountain, mature, 7th ft. Bin 12.
" 6. Green Mountain, mature, 8th ft. Bin 12.

Plate V—Photo 7. Composite picture of varieties stored in crates, Room 5.

Plate V—Photo 8. Composite picture of varieties stored in bags, Room 5.

Plate V—Photo 1. Green Mountain, mature, 1st ft. Bin 12.
" 2. Green Mountain, mature, 2nd ft. Bin. 12.
" 3. Green Mountain, mature, 3rd ft. Bin 12.

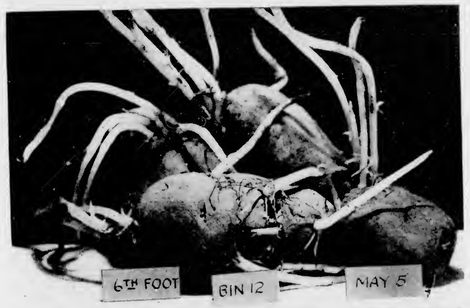

Plate V—Photo 4. Green Mountain, mature, 6th ft. Bin 12.
" 5. Green Mountain, mature, 7th ft. Bin 12.
" 6. Green Mountain, mature, 8th ft. Bin 12.

Plate V—Photo 7. Composite picture of varieties stored in crates, Room 5.

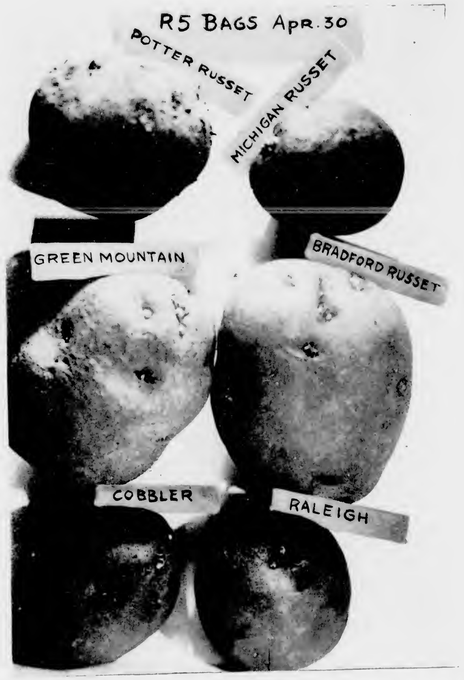

Plate V—Photo 8. Composite picture of varieties stored in bags, Room 5.

INTENTIONAL SECOND EXPOSURE

PLATE VI

EFFECT UPON GERMINATION OF CRATE STORAGE IN A WELL VENTILATED ROOM

The finest example of storage shown in any of the views is presented in the accompanying photographs of crate storage in the open Laboratory cellar, near the outside door.

The varieties shown are Green Mountain, Irish Cobbler, Triumph and Early Ohio.

The stock was absolutely dormant on May 5, 1925. Germination started on May 15, 1925.

The stock was home grown and was picked from the field into crates and stored in the same crates without rehandling. The stock represented is, therefore, run of field stock. There were the usual amount of digger cuts and scrapes in the harvesting of these potatoes. Some of the potatoes were completely cut in two. All of the cut surfaces had suberized, however, and when subjected to a critical examination on May 12 by Dr. Freeman Weiss, Bureau of Plant Industry, U. S. Department of Agriculture, this stock was found to be not only absolutely dormant, but to be free from storage rot. There was also no sign of shriveling. The stock was firm and juicy and apparently as perfect as when taken from the field.

Results here shown agree with those reported in the First (7) and the Fifth (8) Report of The Marble Laboratory Inc.

Plate VI—Photo 1. Green Mountains stored in open cellar in crates.

Plate VI—Photo 3. Irish Cobbler stored in open cellar in crates.

Plate VI—Photo 2. Early Ohio stored in open cellar in crates.

Plate VI—Photo 4. Triumph stored in open cellar in crates.

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EFFECT UPON GERMINATION OF CRATE STORAGE IN A WELL VENTILATED ROOM

The finest example of storage shown in any of the views is presented in the accompanying photographs of crate storage in the open Laboratory cellar, near the outside door.

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Plate VI—Photo 1. Green Mountains stored in open cellar in crates.

Plate VI—Photo 3. Irish Cobbler stored in open cellar in crates.

Plate VI—Photo 2. Early Ohio stored in open cellar in crates.

Plate VI—Photo 4. Triumph stored in open cellar in crates.

CONCLUSIONS

Fundamentally, the proper practice for delaying germination until the end of the storage term resolves itself into storage under conditions favorable for the prompt removal of the products of respiration, including the heat of respiration.

The temperature of the storage is the controlling factor in determining the storage conditions necessary for delaying germination.

When the storage temperature is low, from 30° F. to 35° F. the heat of respiration is so slight that bin storage may be employed with satisfactory results.

When, however, a storage temperature of 38-40° F. is employed, bin storage is apt to result in early germination.

Ventilation is not effective in delaying germination in deep bin storage.

With a storage temperature of 38-40° F. storage in small packages with opportunity for the escape of the products of respiration on all sides of the package is desirable. Crates or bags piled with ample dunnage comply with these requirements.

Ventilation is the most effective agency for removing the products of respiration. It should be employed in sufficient amount to do this promptly and completely.

When the storage temperature is 38-40° F., crate or bag storage with ventilation supplies the proper holding conditions for delaying germination until the end of the storage term.

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APPENDIX A

In this Appendix is given:

The weekly temperature report of temperatures within Bins 1 to 14 inclusive, for the week ending April 4, 1925. The temperatures within each bin read from top to bottom, the top line of figures giving the temperature within the bin on the top foot of potatoes, and so progressively downward until the bottom line of figures give the temperatures within the bin on the bottom foot of potatoes. The number of readings given on each line across the page indicate the number of points along each foot of potatoes within the bin at which temperature records were taken. The manner of taking the temperatures within the bin is explained on page 16.

In addition to the temperatures within the bin there is given, on a line above the temperature record for each bin, the temperature of the air above the bin and the average temperature of the top foot of potatoes; and on a line below the temperature record for each bin, the average temperature for the bottom foot of potatoes.

3-30-25															
BIN 1	Top of Bin			45	AVG.		45								
	44.50	45	44.50	45	45	45	45.50	45.50	45	45	45	45	44.50	45	45
	44.50	45	44.50	45	45	44.50	45	45	45	45	45	45	44.50	45	44.50
	44	44.50	44	45	45	44.50	44.50	45	44.50	44.50	44.50	44	44	44.50	44
	44	44	44	44	44.50	44	44	44.50	44	44	44	44	44	44	44
	44	44	43.50	44	44	43	44	44	43.50	43.50	43.50	43.50	43.50	44	43.50
	43	43	43	43	43	42.50	43	43	43	43	43	43	43	43	43
	42	42	42	42.50	42.50	42	42.50	42.50	42	42.50	42.50	42.50	42	42.50	42
3-30-25						AVG.	42.25								
BIN 2	Top of Bin			45		AVG.	45.4								
	45	45	45	45.50	45.50	45	46	46	45.50	45.50	46	45.50	45	45.50	45
	44.50	45	44.50	45	45.50	45	46	46	45.50	45	46	45	45	45.50	45
	44	44.50	44	45	44.50	44.50	45.50	45.50	45	45	45	45	44	44.50	44.50
	44	44.50	44	44	44.50	44	45	45	44	44	44.50	44	44	44.50	44.50
	44	44	43.50	44	44	43.50	44	44.50	44	44	44	44	44	44	44
	43.50	43.50	43	43.50	43.50	43	44	43.50	43	43.50	43.50	43	43.50	43.50	43
	43	43	42.50	43	43	42.50	43	43	42.50	43	43	43	43	43	43
3-31-25						AVG.	42.9								
BIN 3	Top of Bin			45		AVG.	45.5								
	45	45	45	45.50	46	45.50	46	46	45.50	45	46	46	45	45.50	45
	45	45	45	45.50	45.50	45.50	45.50	45.50	45.50	45	45.50	45.50	45	45.50	45
	44.50	44.50	44.50	45	45	45	45.50	45.50	45	45	45	45	45	45	44.50
	44.50	44.50	44	45	45	44.50	45	45	44.50	45	45	45	44.50	44.50	44
	44	44	43.50	44	44.50	44	44.50	44	44	44	44	44	44	44	43.50
	43	43	43	43.50	43	43	43	43	43	43	43	43	43	43	43
	43	42.50	42.50	43	43	42.50	43	43	43	43	43	43	43	43	42.50
						AVG.	42.9								

3-31-25															
BIN 4	Top of Bin		45.50			AVG.	46.2								
	46.50	46.50	47	47	46	47	47	46	45	46.50	46.50	45.50	45	45.50	46	46
	46	46.50	46.50	45.50	46	46.50	46.50	46	45	46.50	46.50	45	45	45.50	45.50	45
	45	46	46	45	46	46	45.50	44.50	45	45.50	45.50	44.50	44	45	45	44
	44.50	45	45	44	45.50	45.50	45	44	45	45	45	44	44	45	44	44
	44	44	44	43.50	44.50	44.50	44	43	44.50	44.50	44	43	43.50	44	43.50	43
	43	43	43	43	43.50	43.50	43	42.30	43.50	43.50	43.50	43	43	43	43.	43
	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	43	43	43	42.50	42.50	42.50	42.50	42.50
3-31-25						AVG.	42.6									
BIN 5	Top of Bin		44			AVG.	44.35									
	44	44	44	44	45	45	45	44	44.50	44.50	44.50	44.50	44	44	44	44
	44	44	44	43.50	44	44.50	44.50	43.50	44	44	44	44	43.50	43.50	43.50	43.50
	43	43	43	43	43	44	44	43	43.50	43.50	43.50	43	43	43	43	43
	42.50	42.50	42.50	42.50	43	43	43	42.50	43	43	43	42.50	42.50	42.50	42.50	42.50
	42.50	42	42.50	42	42.50	42.50	42.50	42	43	42.50	42.50	42.50	42	42.50	42	42
3-31-25						AVG.	42.25									
BIN 6	Top of BIN		44			AVG.	44									
	44	44	44	43.50	44	44	44									
	43	43	43	43	43.50	43.50	43.50	44	44	44	44	44	44	44	44	44
						AVG.	43.15	43.50	43	43	43	43	43	43	43	43
3-31-25																
BIN 7	Top of BIN		43			AVG.	42.65									
	42.50	42.50	42.50	42.50	42.50	43	43	42.50	42.50	43	43	42.50	42.50	42.50	42.50	42.50
	42.50	42.50	42.50	42.50	42.50	43	43	42.50	42.50	43	42.50	42.50	42.50	42.50	42.50	42.50
						AVG.	42.65									

4-1-25																
BIN 8	Top	of Bin	47.50	AVG.	47.5											
	46	47	47	47	47	48	48	48	47	48	48	48	47	48	48	48
	46	46	46.50	46.50	47	47	48	47	47	48	48	47.50	47	47.50	48	48
	45	46	46	46	47	47	47	46.50	47	47	47	47	46.50	47.50	47.50	47.50
	45	46	46	45	46	46.50	46.50	46	46	46	47	47	46	47	47	47
	45	45	45	44	46	46	46	45	45.50	46	46	46	46	46.50	46.50	46
	44	44	44	43.50	45	45	45	44	45	45	45	45	45.50	46	46	45
	43	43	43	43	44	44	44	44	44	45	45	44	45	45	45	45
4-1-25	Top	of Bin	47.50		AVG.	44.15 / 48										
BIN 9	46	47	47.50	48	47.50	48.50	48.50	49	47	49	49	49	47	48.50	49	49
	46	47	47.50	48	47.50	48.50	48.50	48.50	47	48.50	49	48.50	47	48	48.50	48.50
	45.50	47	47	47.50	46.50	48	48	48	47	48	48	48	47	48	48	48
	45.50	46.50	46.50	46.50	46.50	47.50	47.50	47	46.50	47.50	47.50	47	46.50	47	47	47
	45	46	46	46	46	46.50	47	46	46	47	47	46	46	46.50	46.50	46.50
	44.50	45	45	44.50	45	45	46	45.50	45	45.50	46	45	44.50	45.50	45.50	45.50
	44	44.50	44.50	44	44	44.50	45	44.50	44	44.50	45	44.50	44	44.50	45	44.50
4-1-25					AVG.	44.5										
BIN 10	Top	of Bin	47		AVG.	48										
	46	47.50	48.50	48.50	47	48	49	49	46.50	48.50	49.50	49	46.50	47.50	48.50	49
	46	47	47.50	48	47	48	49	48	46	48	49	48	46.50	47.50	48	48
	45	47	47	47	46	47.50	48	47.50	46	48	48	47.50	46	47.50	48	48
	45	46	46.50	46.	46	47	47.50	47	46	47	47	47	46	47	47	47
	45	45.50	45.50	45.50	45	46	46.	46	45	46	47	46	45	46	46.50	46
	44	44.50	44.50	44.50	44.50	45	45.50	45	44	45.50	46	45	44	45.50	45.50	45
					AVG.	44.9										

4-2-25	Top	of Bin		47		AVG.	48.1									
BIN 11	46	47.50	48.50	49	47	48	49.50	49.50	47	48.50	49	49	46	47.50	49	49
	45	47	47.50	48	47	48	49	48.50	46.50	48.50	49	48.50	46	47.50	48.50	48.50
	44	47	47	48	46	48	48.50	48	46	48	48.50	48	45	47.50	48	48
	44	45	46	47	46	47.50	48	47	46	47.50	48	47	45	47	47.50	47
	44	45	46	45	45.50	46.50	47	46	45	47	47	46.50	45	47	47	46.50
	44	45	45	44.50	45	46	46	45	45	46	46	45	45	46	46	45.50
	44	45	44	44	44	45	45	44	44	45	45	44	44	45	45	44
4-2-25	Top	of Bin		47.50		AVG.	44.5 / 47.3									
BIN 12	46	47	47.50	47.50	46.50	47.50	48	48	46	47.50	48	48	46	47.50	48	48
	46	47	47.50	47.50	46.50	47.50	48	48	46	47.50	48	48	46	47	48	48
	46	47	47.50	47.50	46	46.50	48	47.50	46	47	47.50	47.50	46	47	47.50	47.50
	45	46	46	46.50	46	46.50	47	47	46	47	47	47	45:50	46.50	47	47
	45	45	45	45	45	46.50	46.50	46.50	45.50	46.50	46.50	46.50	45.50	46.50	46.50	46.50
	44	44	44	45	44	45	45.50	45	44.50	45.50	45.50	45.50	44	45	45	45
	43.50	44	44	44	44	44.50	45	44.50	44	44.50	44.50	44.50	43.50	44	44	44
BIN 13	Top	of Bin		47.50		AVG.	44.2 / 47.6									
	46.50	47.50	47.50	48	47.50	48.50	49	48.50	46.50	48.50	49	48	46	47	47.50	47
	46.50	47.50	47.50	47.50	47.50	48.50	49	48	46.50	48	48.50	48	46	47	47.50	47
	45.50	47	47	47	46	47	48	48	46	47.50	48	47.50	46	46.50	46.50	46.50
	45	46	46.50	46.50	46	47	47.50	46.50	46	47.50	47.50	46.50	45	46	46	46
	45	45.50	45.50	45.50	45.50	46.50	46.50	45.50	45	46	46	45	45	45	45	45
	44	44.50	44.50	44.50	45	45.50	45.50	45	45	45.50	45.50	45	44	44.50	44.50	44
	43	43	43	43.50	44	44	44.50	44.50	43.50	44.50	44.50	43.50	43.50	44.50	44	43
						AVG.	43.75									

4-4-25	Top	of Bin	40		AVG.	41.50										
BIN 14	41	42	42	41	42	42	42	41	42	42	42	41	42	41.50	41	40
	41	42	42	41	41.50	42	42	41	42	42	42	41	42	41.50	41	40
	40	41	41	41	41	42	41.50	41	41.50	41.50	41.50	41	41	41	41	40
	40	40	40	40	40	41	41	40	40	41	41	40	40	41	41	40
	40	40	40	40	40	40	40.50	40	40	41	41	40	40	41	41	40
	39	39.50	39.50	39	39[illegible]	40	40	40	40	40	40	40	40	40	40	40
					AVG.	39.75										

Temperature Readings, Bin 14, week ending March 30, 1925

APPENDIX B

The tables herewith give weekly readings of temperature and humidity records thruout the storage period for each of the storage bins, together with certain other data indicated by the headings at the top of the charts. It was from these charts that the chart presented in Figure 3, was drawn, using the temperature differences shown at the last column of the charts presented herewith. It is thought that this information may be of value to those who wish to closely examine the temperature records.

BIN 1
One air change per hour.

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-17-24			40	85	-	-	45	67	42.3	50.5	8.2
11-25-24			43	85	46	-	45	66	44	46	2.
12-2-24			42	84	43.25	44	43	64.5	42.7	46.75	4.05
12-8.24	50	89	44	97	44	44.5	44	71	43.25	45.95	2.9
12-16.24			40	83	41	45	42.5	69	42	46.3	4.3
12-22-24			40	80	40	43	42	70	41.5	44.5	3.
12-29-24			36	79	36	38.5	39	66	37.15	41	3.85
1-5-25			38	89	36.5	37	37	70	36.5	38.25	1.75
1-12-25			38	90	36.5	38	38	69	37	38.75	1.75
1-19-25			37	84	36.5	37.5	37.5	67	36.75	38.75	2.
1-26.25			36	88	36	36.5	36	70	35.25	37.9	2.65
2-2-25			35	89	35	35	35	70	34.15	36.35	2.25
2-9-25			40	98	38	37	36	72	35.75	36.5	.75
2-16-25			40	90	38.5	39	39	70	38.5	39.37	.87
2-23-25			42	99	41	41	40	75	39.4	41.2	1.8
3-3-25			44	77	36	41	38	69	38	42	4.
3-9-25			48	94	38	39	38	71	38.15	40.15	2.
3-16-25			48	90	39.5	41	39	67	40	41.5	1.5
3-23-25			49	90	41	43	40	70	41.25	43.33	2.08
3-30-25			44	88	42.5	45	43	68	42.25	45	2.75
4-6-25			40	70	36.5	45.5	43	86	39	45	6.
4-13-25			45	77	44	45	45	77	41.85	44.75	2.9
4-23-25			51	90	48	47	46	85	41.35	47	5.65

BIN 1. Table giving weekly readings of temperature and humidity thruout the storage period

BIN 2
Two air changes per hour

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-17-24			40	85	-	-	44	71	43	50	7.
11-25-24			43	85	45	-	45	65	44	46.25	2.25
12-2-24	50	89	42	84	41.5	45	42.5	63	42.3	46.5	4.2
12-8-24			44	97	43.75	44.75	43.5	70	43.25	45.56	2.31
12-16-24			40	83	40.5	45	42	65	41.5	45.5	4.
12-22-24			40	80	39.5	42.5	42	69	41	44.25	3.25
12-29-24			36	79	35.5	39	38	67	36.5	40.75	4.25
1-5-25			38	89	36.5	37	37	69	36.5	38.5	2.
1-12-25			38	90	36.25	38.5	38	69	37	38.75	1.75
1-19-25			37	84	36.25	37.5	37.5	67	36.75	39	2.25
1-26-25			36	88	35.5	36.5	36	69	35.25	38	2.75
2-2-25			35	89	35	35	35	68	34.35	36.5	2.15
2-9-25			40	98	38.25	37	36	72	36	36.75	.75
2-17-25			40	90	39	39	38	69	39	40	1.
2-23-25			42	99	41	40.5	40	74	40.1	41.5	1.4
3-3-25			44	77	36	41	38	69	38	42.5	4.5
3-9-25			48	94	38	40	38	70	38.35	40.25	1.9
3-16-25			48	90	39.5	41	39	67	40	41.8	1.8
3-23-25			49	90	41	43	40	70	41.75	43.43	1.68
3-30-25			44	88	42.5	45	43	68	42.9	45.4	2.5
4-6-25			40	70	36.5	46	42	84	39.5	45.5	6.
4-14-25			45	86	43.5	45.5	43.5	78	42	45	3.
4-23-25			51	90	48	47.75	46	85	41.35	47	5.65

BIN 2. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 3
Three air changes per hour

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-17-24			40	85	-	-	44	76	42	48.6	6.6
11-25-24			43	85	44.5	-	45	65	43.7	45.7	2.
12-2-24			42	84	41.5	45	43.5	64	42	45.8	3.8
12-9-24	38	55	42.5	84	43.75	44.5	44.5	70	43	44.8	1.8
12-16-24			40	83	40.75	44	42.5	65	41	44.5	3.5
12-22-24			40	80	40	42.25	42.5	68.5	40.7	44	3.3
12-30-24			36.5	82.5	35.5	38	37.5	66	36	39.15	3.15
1-5-25			38	89	36.5	37	37	71	36	37.8	1.8
1-12-25			38	90	36.5	38	38	69	36.6	38.5	1.9
1-19-25			37	84	36.25	37.5	37.5	69	36	38.25	2.25
1-27-25			35	83	35.5	37	35.5	69	35.25	37.3	2.05
2-3-25			35	83	34.5	35	34	69	34	36	2.
2-9-25			40	98	38.25	38	36	74	36.5	36.85	.35
2-17-25			40	90	39	39.5	39	71	39.25	40	.75
2-24-25			42	96	41	41.5	41	74	40.75	42.25	1.5
3-3-25			44	77	36	41.5	38	72	37.5	41.4	3.9
3-9-25			48	94	38.25	39	39	70	38.15	40	1.85
3-16-25			48	90	40	41	40	65	40.4	41.6	1.2
3-23-25			49	90	41	43	41	67	42	43.5	1.5
3-31-25			43	85	42.5	45	42.5	72	42.9	45.5	2.6
4-6-25			40	70	36.5	45	41	85	38.25	44.33	6.08
4-14-25			45	86	43.5	44	43	80	42	44	2.
4-23-25			51	90	48	47	45	86	42	46.5	4.5

BIN 3. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 4
Four air changes per hour

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-17-24			40	85	-	-	42	55	39	48.25	7.25
11-26-24			44	85	43.5	-	44	67	43.25	46.8	3.55
12-2-24			42	84	41.25	44.5	40.5	62	41	46.8	5.8
12-9-24	38	55	42.5	84	44	46	43.5	75	43.2	45.65	2.35
12-17-24			41	88	41.5	45	41.5	73	41	45.2	4.2
12-23-24			39	80	39	44	38	64	38.5	44	5.5
12-30-24			36.5	82.5	34.5	38	35	66	34.25	39	4.75
1-6-25			38	90	36.25	38.5	36.5	76	36.5	38.2	1.7
1-13-25			38	89	36.5	38.5	37.	80	36.25	39	2.75
1-20-25			37	85	36	38	36.5	70	36.25	38.75	2.5
1-28-25			34	78	33.75	36	33	63.5	33.37	38	4.63
2-3-25			35	83	34	37	34.5	70	34	36.87	2.87
2-10-25			40.5	98	39.25	41	40	88	37.5	39.25	1.75
2-17-25			40	90	39	41	40	83	39.5	41.5	2.
2-24-25			42	96	41.25	43.5	42	86	41	43.5	2.5
3-4-25			44.5	82	35.5	41	36	73	36	40.75	4.75
3-10-25			48.5	96	39.25	41	40	85	38.5	40.25	1.75
3-17-25			48	92	39.75	43	41	80	39.75	42.5	2.75
3-24-25			49.5	91	41.25	44	42	79	41.11	44.31	3.2
3-31-25			43	85	42.5	45.5	42.5	80	42.6	46.2	3.6
4-6-25			40	70	36	42.5	37	69	35.75	41.8	6.05
4-14-25			45	86	43.5	44.5	43	95	41.15	44	2.85
4-23-25			51	90	48.5	50.5	47	90	39.9	47.4	7.5

BIN 4. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 5
Four air changes per hour.

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-18-24			41.5	85	-	-	42	57	39	44.5	5.5
11-26-24			44	85	43-5	-	44	67	43	45.25	2.25
12-3-24			43	85	41-5	44	40.5	64	40.25	44.5	4.25
12-10-24	29.5	65	41	85	43.75	44.25	43	69	43	44.5	1.5
12-17-24			41	88	41.5	43.25	41.5	73	40.75	43.25	2.5
12-23-24			39	80	39	41	38	64	38.5	41	2.5
12-30-24			36.5	82.5	34.5	37	35	66	34.5	36.5	2.
1-6-25			38	90	36.25	38.25	36.5	76	36.4	37	.6
1-13-25			38	89	36.5	38	37	80	36.25	38.1	1.85
1-20-25			37	85	36	37.5	36.5	70	36	37.5	1.5
1-28-25			34	78	33.75	36	33	63.5	33	35.65	2.65
2-4-25			35	86	34	35	34.5	71	34	35.3	1.3
2-10-25			40.5	98	39.25	39.5	40	88	37.25	38.1	.85
2-18-25			39	86	37.5	40.5	40	80	39	40.85	1.85
2-24-25			42	96	41-25	42.5	42	86	41	42	1.
3-4-25			44.5	82	35.5	39	36	73	36	38.25	2.25
3-10-25			48.5	96	39.25	40	40	85	38.5	39	.5
3-18-25			49	94	40.5	42	41	84	39.75	41	1.25
3-24-25			49.5	91	41.25	43	42	79	41	43	2.
3-31-25			43	85	42.5	44	42.5	80	42.25	44.35	2.1
4-7-25			43	74	38.75	39	39	74	36.6	38.5	1.9
4-14-25			45	86	43.5	43	43	95	41.25	42.5	.75
4-24-25			52	90	43	50	50	88	41.1	49.6	8.5

BIN 5. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 6
Four air changes per hour

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-18-24			41.5	85	-	-	42	57	41.25	43	1.75
11-26-24			44	85	43.5	-	44	67	44.7	45	.3
12-3-24			43	85	41.5	45.2	40.5	64	42	43	1.
12-10-24	29.5	65	41	85	43.75	44.5	43	69	44	44.43	.43
12-17-24			41	88	41.5	43	41.5	73	41.8	42.7	.9
12-23-24			39	80	39	41	38	64	39.5	40.4	.9
12-31-24			36	83	34.75	37	35	71	36	36.25	.25
1-7-25			38	89	36.75	38	37	79	37	37.25	.25
1-13-25			38	89	36.5	38	37	80	37	38	1.
1-20-25			37	85	36	37.25	36.5	70	37	37.5	.5
1-28-25			34	78	33.75	36	33	63.5	34.1	35.65	1.55
2-4-25			35	86	34	36	34.5	71	35	35.37	.37
2-10-25			40.5	98	39.25	40	40	88	37.85	38	.15
2-18-25			39	86	37.5	40.5	40	80	40	40.65	.65
2-24-25			42	96	41.25	43	42	86	41.8	41.8	.0
3-4-25			44.5	82	35.5	38	36	73	37	37.5	.5
3-10-25			48.5	96	39.25	40	40	85	38.85	39	.15
3-18-25			49	94	40.5	41.5	41	84	40.35	41	.65
3-24-25			49.5	91	41.25	43	42	79	42.12	42.75	.63
3-31-25			43	85	42.5	44	42.5	80	43.15	44	.85
4-7-25			43	74	38.75	39	39	74	37.25	38.25	1.
4-15-25			47	80	43.75	44.5	44	93	43	43.4	.4
4-24-25			52	90	43	52	50	88	46.75	51.35	4.6

BIN 6. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 7. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 7
Four air changes per hour.

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN TEMPERATURE OF BIN	AVERAGE MAX TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-18-24			41.5	85	-	-	42	57	39	39.75	.75
11-26-24			44	85	43.5	-	44	67	43	44	1.
12-3-24			43	85	41.5	40.6	40.5	64	40.6	41.2	.6
12-10-24	29.5	65	41	85	43.75	43.5	43.	69	43	43.38	.38
12-17-24			41	88	41.5	41.75	41.5	73	40.6	41	.4
12-23-24			39	80	39	39	38	64	38.25	38.5	.25
12-31-24			36	83	34.75	35.5	35	71	34.75	34.87	.17
1-7-25			38	89	36.75	37.5	37	79	36.5	36.5	.-
1-13-25			38	89	36.5	37	37	80	36.5	36.5	.0
1-20.25			37	85	36	36.5	36.5	70	36.2	36.2	.0
1-28-25			34	78	33.75	33	33	63.5	32.85	33	.15
2-4-25			35	86	34	34.5	34.5	71	34.15	34.3	.15
2-10-25			40.5	98	39.25	39	40	88	37.5	37.5	.0
2-18-25			39	86	37.5	40	40	80	39	39.35	.35
2-24.25			42	96	41.25	41.5	42	86	41	41.25	.25
3-4-25			44.5	82	35.5	37	36	73	36	36.35	.35
3-1025			48.5	96	39.25	39	40	85	38.3	38.37	.07
3-18-25			49	94	40.5	40	41	84	39.75	39.75	.0
3-24-25			49.5	91	41.25	42	42	79	41.12	41.12	.0
3-31-25			43	85	42.5	43	42.5	80	42.65	42.65	.0
4-7-25			43	74	38.75	37.5	39	74	36.25	36.58	.33
4-15-25			47	80	43.75	43	44	93	41.75	42.15	.4
4-24-25			52	90	43	46	50	88	41.75	43.5	1.75

BIN 8. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 8
No air change

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-18-24			41.5	85	-	-	44	65	42.8	48	5.2
11-28-24			44	85	-	-	45	76	45	47.3	2.3
12-5-24			42	86	-	46	42.5	73	43.25	46.1	2.85
12-11-24	30	60	42	85	-	46	44	71	44.28	46.75	2.47
12-18-24			42	91	-	46.25	43	76.5	43	46.4	3.4
12-24-24			39	82	-	43.5	41.5	73	41.6	44.34	2.74
1-1-25			35	81	-	40	38	76	38.6	41.5	2.9
1-8-25			38	89	-	40	38.5	75	39.75	41	1.25
1-14-25			37	85	-	41	38.5	76	40	41.5	1.5
1-21-25			37	86	-	40	38	75	39	41.2	2.2
1-29-25			33	80	-	39	35.5	72	37.5	40	2.5
2-4-25			35	86	-	38.5	36	75	37.5	38.75	1.25
2-11-25			40.5	98	-	41	40	75	39.75	40.75	1.
2-18-25			39	86	-	42.5	40	75	41.5	42.9	1.4
2.25-25			41	96	-	44.5	42.5	76	42.5	44.5	2
3-4-25			44.5	82	-	43	39	74	39.6	43.2	3.6
3-11-25			49	97	-	43	41	76	40.8	42.9	2.1
3-18-25			49	94	-	44	42	75	42.	44.3	2.3
3-24-25			49.5	91	-	46.5	43	74	43	45.88	2.88
4-1-25			40	82	-	47.5	43	80	44.15	47.5	3.35
4-7-25			43	74	-	45.5	42	77	39.78	45.25	5.47
4-15-25			47	80	-	48	45.5	85	43.4	47.6	4.2
4-24-25			52	90	-	51	51	83	43	50.5	7.5

BIN 9
No air change

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-20-24			44	86	-	-	43.5	70	44	46	2
11-28-24			44	85	-	-	45	76	45.5	47.25	1.75
12-6-24			42.5	89	-	46	42	74	44.25	47	2.75
12-11-24	30	60	42	85	-	46.5	44	71	45	47.37	2.37
12-18-24			42	91	-	46.25	43	76.5	44.5	47.35	2.85
12-24-24			39	82	-	43	41.5	73	43	46	3
1-1-25			35	81	-	40	38	76	40.5	43	2.5
1-8-25			38	89	-	41	38.5	75	41.25	42.5	1.25
1-14-25			37	85	-	40.5	38.5	76	41	42.5	1.5
1-21-25			37	86	-	40	38	75	40.5	41.6	1.1
1-29-25			33	80	-	39	35.5	72	39	40.65	1.65
2-5-25			35.5	88	-	38	36	75	38.75	40.5	1.75
2-11-25			40.5	98	-	42	40	75	41	41.5	.5
2-19-25			39	88	-	43	40	75	42	43.4	1.4
2-25-25			41	96	-	44	42.5	76	43	45.25	2.25
3-5-25			45	87	-	44	39	73	41	44.5	3.5
3-12-25			48	94	-	44	41.5	75	42	43.75	1.75
3-19-25			49.5	95	-	44	42.5	74	43	45.3	2.3
3-25-25			47	91	-	46	43	74	43.81	46.65	2.84
4-1-25			40	82	-	47.5	43	80	44.5	48	3.5
4-8-25			44	65	-	46.5	43	80	42.6	46.75	4.15
4-16-25			43	68	-	48	45	83	44.35	48.5	4.15
4-25-25			52	93	-	52	52	83	45	50.75	5.75

BIN 9. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 10
No air change.

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-28-24			44	85	-	-	45	76	46.5	49	2.5
12-6-24			42.5	89	-	45	42	74	45.25	47.4	2.15
12-11-24	30	60	42	85	-	46.5	44	71	46	47.71	1.71
12-18-24			42	91	-	45	43	76.5	45.5	47.5	2
12-24-24			39	82	-	43	41.5	73	41.5	46.36	4.86
1-2-25			35	83	-	39.5	38	76	41.25	43	1.75
1-8-25			38	89	-	40.5	38.5	75	41.75	42.5	.75
1-14-25			37	85	-	40.5	38.5	76	41.5	42.4	.9
1-22-25			37	86	-	40	38	75	41	42.1	1.1
1-29-25			33	80	-	38.5	35.5	72	39.75	41.25	1.5
2-5-25			35.5	88	-	39	36	75	39.5	40.5	1.
2-12-25			40	94	-	42	40.5	74	41.75	42.	.25
2-19-25			39	88	-	43	40	75	42.5	44	1.5
2-26-25			39	90	-	44	42.5	75	43.75	45.5	1.75
3-5-25			45	87	-	42	39	73	41.6	43.8	2.2
3-12-25			48	94	-	44	41.5	75	42.5	43.65	1.15
3-19-25			49.5	95	-	44	42.5	74	43.7	45.3	1.6
3-25-25			47	91	-	45.5	43	74	44.11	46.35	2.24
4-1-25			40	82	-	47	43	80	44.9	48	3.1
4-8-25			44	65	-	47	43	80	43.31	47	3.69
4-16-25			43	68	-	48	45	83	45.45	50	4.55
4-25-25			52	93	-	53	52	83	46	54	8.

BIN 10. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 11. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 11
No air change

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN TEMPERATURE OF BIN	AVERAGE MAX TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-29-24			43	85	-	-	44	72	47	48.3	1.3
12-6-24			42.5	89	-	46	42	74	45	48	3
12-12-24	28.6	65	41.5	86	-	47	44	71	46.2	48.56	2.36
12-19-24			42	92	-	45.5	44	76.5	45.5	48.5	3.5
12-26-24			37	78	-	43.5	40.5	72	43.43	46.68	3.25
1-2-25			35	83	-	41	38	76	41.75	43.1	2.35
1-9-25			37.5	87	-	40.5	38.5	75	41.5	42.5	1.
1-16-25			36	85	-	40	38	75	41.5	43	1.5
1-22-25			37	86	-	40	38	75	41	42.2	1.2
1-30-25			34	85	-	38	35.5	72	39	41	2.
2-6-25			36.5	92	-	38	37	74	39.75	40.4	.65
2-12-25			40	94	-	42	40.5	74	41	41.5	.5
2-19-25			39	88	-	43	40	75	42.35	43.5	1.15
2-26-25			39	90	-	44	41.5	74	43.7	45.5	1.8
3-5-25			45	87	-	43	39	73	41.5	44.5	3.
3-12-25			48	94	-	43	41.5	75	42.3	43.8	1.5
3-19-25			49.5	95	-	44	42.5	74	43.5	45.15	1.65
3-26-25			44	91	-	46	43.5	75	44.38	46.5	2.12
4-2-25			41	84	-	47	42.5	80	44.5	48.1	3.6
4-9-25			41	75	-	47.5	42	82	42.87	47.62	4.75
4-16-25			43	68	-	48	45	83	44.5	49	4.5
4-27-25			54	74	-	53	52	84	47.6	52	4.4

BIN 12. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 12
No air change

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN TEMPERATURE OF BIN	AVERAGE MAX TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
12-6-24			42.5	89	-	44.25	42	74	44	45.25	1.25
12-12-24	28.6	65	41.5	86	-	46	44	71	45.5	47.23	1.73
12-19-24			42	92	-	44.5	44	76.5	45.5	47.5	2
12-26-24			37	78	-	43.75	40.5	72	43.25	46.18	2.93
1-3-25			36	87	-	40	37.5	76	42.3	43.2	.9
1-9-25			37.5	87	-	40	38.5	75	41.5	42	.5
1-16-25			36	85	-	40	38	75	41	42.1	1.1
1-22-25			37	86	-	40	38	75	41	42	1.
1-30-25			34	85	-	39	35.5	72	39.25	41	1.75
2-6-25			36.5	92	-	38.5	37	74	39.35	40	.65
2-12-25			40	94	-	42	40.5	74	41	41.35	.35
2-20-25			39	90	-	42	40	75	42	43.1	1.1
2-26-25			39	90	-	44	41.5	74	43.4	45	1.6
3-6-25			45	88	-	42	39	74	41.35	44.2	2.85
3-13-25			48	92	-	43	41.5	73	42.35	43.75	1.4
3-20-25			49	94	-	43.5	42.5	75	43.1	44.5	1.4
3-27-25			44.5	92	-	45.5	44.5	75	44	46.5	2.5
4-2-25			41	84	-	47.5	42.5	80	44.2	47.3	3.1
4-9-25			41	75	-	47	42	82	43	46.9	3.9
4-17-25			44	70	-	48	44.5	82	44.25	48.62	4.37
4-27-25			54	74	-	54	52	84	47.75	55.9	8.15

BIN 13
No air change

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
12-20-24			39.5	83	-	46	43	76	45.5	47.5	2
12-27-24			36.5	79	-	44	39.5	71.5	42.75	46.31	3.56
1-3-25			36	87	-	41	37.5	76	40.6	43	2.4
1-10-25			37.5	87	-	40.5	38.5	75	41.5	42.5	1
1-17-25			36.5	88	-	41	38	75	41	42.5	1.5
1-23-25			34.	78	-	40	37	74	40.5	42	1.5
1-31-25			34	86	-	39	35.5	73	39	40.5	1.5
2-7-25			37	94	-	39	37	74	39.5	40.1	.6
2-13-25			39	88	-	42	40	72	41	41.75	.75
2-20-25			39	90	-	42.5	40	75	41.75	43.35	1.6
2-27-25			39	85	-	44.5	41.5	74	43.1	44.75	1.65
3-6-25			45	88	-	42	39	74	41	43.5	2.5
3-13-25			48	92	-	43	41.5	73	42	43.5	1.5
3-20-25			49	94	-	44	42.5	75	43	44.8	1.8
3-27-25			44.5	92	-	46	44.5	75	44	46.25	2.25
4-2-25			41	84	-	47.5	42.5	80	43.75	47.6	3.85
4-9-25			41	75	-	47	42	82	42.45	47.1	4.65
4-17-25			44	70	-	47.5	44.5	82	43.5	48.9	5.4
4-27-25			54	74	-	53	52	84	46.75	55.4	8.65

BIN 18. Table giving weekly readings of temperature and humidity thruout the storage period.

BIN 14
No air change.

Date			AVERAGE CELLAR TEMPERATURE	AVERAGE CELLAR HUMIDITY	INCOMING AIR TEMPERATURE	TEMPERATURE TOP OF BIN	AVERAGE ROOM TEMPERATURE	AVERAGE ROOM HUMIDITY	AVERAGE MIN. TEMPERATURE OF BIN	AVERAGE MAX. TEMPERATURE OF BIN	TEMPERATURE DIFFERENCE
11-29-24			OLD CELLAR		-	-	40	71	38.5	42	3.5
12-6-24			"	"	-	41	38.5	75	39.75	41.25	1.5
12-12-24	28.6	65	"	"	-	40.5	39.5	62	40	41.7	1.7
12-20-24			"	"	-	38.5	37	60	38.5	39.75	1.25
12-27-24			"	"	-	34.5	33	64	34.31	36.5	2.19
1-3-25			"	"	-	34.5	33	69	34.8	35.5	.7
1-10-25			"	"	-	35	34	71	36.5	36.8	.3
1-17-25			"	"	-	36	33	71	35	36.4	1.4
1-24-25			"	"	-	34	31.5	68	33.9	35.25	1.35
1-31-25			"	"	-	33	31	69	33	34.5	1.5
2-7-25			"	"	-	35	34	75	34.5	35	.5
2-14-25			"	"	-	37	36	72	37	38	1.
2-21-25			"	"	-	37.5	35	73	37.3	38.85	1.55
2-28-25			"	"	-	35	29	40	31.25	36	5.25
3-7-25			"	"	-	34	32.5	71	33	34	1.3
3-14-25			"	"	-	35	36	73	36.3	36	-.3
3-21-25			"	"	-	37	37	73	37.85	37.35	-.5
3-28-25			"	"	-	39	39	72	39.25	39.5	.25
4-4-25			"	"	-	40	39	75	39.75	41.5	1.75
4-10-25			"	"	-	42	40	76	39.85	42.1	2.25
4-17-25			"	"	-	43	41.5	71	41.5	44	2.5
4-27-25			"	"	-	52	50	75	45.45	52.5	7.05
			"	"							

BIN 14. Table giving weekly readings of temperature and humidity thruout the storage period.

II

Report of Condition of Potatoes in Experimental Storage in The Marble Laboratory at Canton, Pa., when Stock Entered Storage, and also when Stock was Removed from Storage, together with a Discussion of the Results

W. A. McCUBBIN

Plant Pathologist, Bureau of Plant Industry,
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Report of Condition of Potatoes in Experimental Storage in The Marble Laboratory at Canton, Pa., when Stock Entered Storage, and also when Stock was Removed from Storage, together with a Discussion of the Results

BY

W. A. McCUBBIN

A report of the condition of the potatoes brought in for Experimental Storage was made during the period of November 12, 13 and 14, 1924, by K. W. Lauer, Ass't. Plant Pathologist in The Department of Agriculture. R. E. Hartman, Plant Pathologist of the Department assisted in this work in helping the methods for making observations. Mr. Lauer's report follows.

This inspection was made according to instructions from R. E. Hartman, Plant Pathologist, Bureau of Plant Industry, Harrisburg, Pa. The following is a copy of the instructions:

"Following my telegram asking you to go to Canton, the following results are desired:

"Mr. Marble would like to know what percentage of the stock he now has is eligible for certification when properly graded. For this reason it was decided to ascertain this information on the following bases:

"1. Secure the total weight of "discards" or "sort outs" from a given quantity of potatoes. It was decided to carefully inspect fifteen (15) bushels from each of the bins, they hold one hundred and fifty (150) bushels or ten per cent (10%), to be inspected. You will also inspect ten per cent (10%) of the crates and bags.

"When you have separated the "sort outs" re-divide them into

(a) Frost.
(b) Cuts and bruises.
(c) Wireworm and grub worm.
(d) Growth cracks.
(e) Rhizoctonia injury.
(f) Bin or storage rots.

"Please make your report direct to me, giving your results for each division of seed inspected.

"Your basis for sorting will be the standard for certification, which, of course, is not perfect nor will it ever be.

"Signed—R. E. HARTMAN."

It was found necessary to add several additional classifications in order to properly classify the various conditions as I found them. A complete classification of the sort-outs is therefore as follows:

(a) Frost Rot.
(b) Cuts and Bruises.
(c) Wire Worms and Grub Injury.
(d) Growth Cracks.
(e) Rhizoctonia Injury.
(f) Bin or Storage Rots.
(g) Sunburn.
(h) Culls.
(i) Common Scab.
(j) Blight Rot.

These sort-outs were grouped as nearly as possible on the following basis:

a. FROST ROT

Included all tubers which showed evidence of rot due to frost. Many tubers were found that had rotted completely and were destroyed almost entirely during handling. This was evidenced by bits of rot which adhered to unrotted tubers.

b. CUTS AND BRUISES

All tubers with deep cuts, or cuts and bruises which disfigured the tuber to any marked extent, were included in this group. Tubers with a small clean cut on the side or end, which had healed over nicely, were not included in the sort-outs.

c. WIRE WORM AND GRUB INJURY

Tubers injured to such an extent as to cause their appearance to be affected were included in this group.

d. GROWTH CRACKS

Only tubers with wide deep cracks and unsightly in appearance were included as sort-outs. Well formed tubers with small growth cracks, but otherwise sound and smooth, were not included.

e. RHIZOCTONIA INJURY

This group included only such tubers which showed that the skin had been injured by this disease. Tubers showing the common black scurf stage were not included. Several tubers included in this group were of such a nature as to indicate that their injury **might** possibly have been the result of some other cause.

f. BIN OR STORAGE ROTS

There were no bin or storage rots found.

g. SUNBURN

Only tubers that were distinctly greened were included here. The amount found under this group was very small.

h. CULLS

This group included large tubers which weighed more than 12 ounces, small tubers, varietal mixtures, tubers with second growths, spindle tubers, and tubers which were distinctly off-type, poorly shaped and very rough.

i. COMMON SCAB

Very few tubers were found that fell into this group.

j. LATE BLIGHT ROT

Only one tuber was found that showed signs of Late Blight Rot.

In all cases 10% of the total amount of potatoes stored was removed and inspected. Where the storage was in bulk, the desired amount was secured by taking the run of the bin from a strip approximately 3 feet wide, running from front to rear and down thru the center of the bin. Where the storage was in crates, 10% of the crates were removed and inspected by selecting the crates promiscuously from the several tiers in the bin. This method it was thought would give as near a representative lot of all potatoes stored as it was possible to secure. The results should therefore be accurate and should represent a fair average for the entire lot.

The potatoes inspected were all sorted by hand on a sorting table and practically every potato gone over individually.

DATA ON POTATOES IN EXPERIMENTAL STORAGE AT CANTON, PA.

Room No.	Bin No.	Crate No.	Storage*	Total Bu. Stored	Total Wt. Inspected**	Frost Rot		Cuts and Bruises		Wire Worm and Grub Injury		Scab		Total Sort-Outs	
						Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
2		1	C	10	58.75	.5	.85	4.50	7.66	1.25	2.13	2.5	4.26	13.00	22.13
3		1	C	10	58.00			5.00	8.62	3.25	5.60			15.75	27.16
5		1	C	10	60.00	.25	.42	3.00	5.00	3.5	5.83			9.50	15.83
1		1	C	10	58.50			4.75	8.12	.5	.85			7.25	12.39
1	1		B	150	843.50	2.75	.33	30.25	3.59	34.75	4.12			116.75	13.84
2	2		B	146	833.50	5.50	.66	16.00	1.92	9.50	1.14			78.00	9.36
3	3		B	140	781.00	2.75	.35	25.75	3.30	35.25	4.51			120.75	15.46
4	4		B	144	811.50	7.0	.86	15.75	1.94	19.25	2.37			80.75	9.95
	5		B	106	607.00	2.25	.37	12.75	2.10	31.50	5.19	.50	.08	90.25	14.87
4	6		B	53	311.00	1.5	.48	10.25	3.30	22.25	7.15			46.25	14.87
4	7		B	53	316.25	.50	.16	9.50	3.00	19.25	6.09	.25	.08	49.00	15.49
5	8		B	152	829.75	3.75	.45	23.00	2.77	37.5	4.52			115.75	13.95
4		1	C	10	59.0	1.75	2.97			2.75	4.66			8.50	14.41
		1	OC-C	10	56.5	.25	.44	1.75	3.10	2.5	4.42			9.75	17.25
	1		OS-B	150	863.0	2.25	.26	43.25	5.01	82.5	9.56	.5	.06	184.50	21.37
Grand Total				1154	6547.25	31.00	.47	205.50	3.14	305.50	4.67	.02	.06	945.75	14.44

Room No.	Bin No.	Crate No.	Storage*	Total Bu. Stored	Total Wt. Inspected**	Growth Cracks		Blight Rot		Sunburn		Culls		Rhizoctonia Injury		Scab		Total Sort-Outs	
						Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
2		1	C	10	58.75	.5	.85					3.75	6.38			2.5	4.26	13.00	22.13
3		1	C	10	58.00	.75	1.29			.75	1.29	6.0	10.34					15.75	27.16
5		1	C	10	60.00					.25	.42	2.5	4.17					9.50	15.83
1		1	C	10	58.50	.5	.85					1.25	2.14	.25	.43			7.25	12.39
1	1		B	150	843.50	1.25	.15			1.25	.15	46.0	5.45	.50	.06			116.75	13.84
2	2		B	146	833.50	1.0	.12			4.0	.48	42.0	5.04					78.00	9.36
3	3		B	140	781.00	2.0	.26			4.0	.51	51.0	6.53					120.75	15.46
4	4		B	144	811.50	1.75	.21			.75	.09	36.25	4.47					80.75	9.95
	5		B	106	607.00	.75	.12			1.25	.20	40.75	6.71	.50	.08	.50	.08	90.25	14.87
4	6		B	53	311.00	1.75	.56			.25	.08	10.25	3.30					46.25	14.87
4	7		B	53	316.25	.25	.08			2.25	.71	17.0	5.37			.25	.08	49.00	15.49
5	8		B	152	829.75	1.0	.12			2.0	.24	48.5	5.85					115.75	13.95
4		1	C	10	59.0	1.0	1.69	.75	1.27	.5	.85	1.75	2.97					8.50	14.41
		1	OC-C	10	56.5					.25	.44	5.0	8.85					9.75	17.25
	1		OS-B	150	863.0					2.0	.23	54.0	6.26			.5	.06	184.50	21.37
Grand Total				1154	6547.25	12.50	0.19	.75	0.01	19.50	.30	366.00	5.59	1.25	.02	3.75	.06	945.75	14.44

* Storage: C—Stored in crates. B—Stored in bulk. OC—Stored in open cellar. OS—Old storage house.

** Total Weight Inspected: The amount inspected is equivalent to approximately 10 per cent. of the total amount stored. The crate was used as the unit of measurement of all tubers that went into storage; it was likewise used as the unit of measurement of all tubers that were taken out for inspection. By following this method it was calculated that 10 per cent. of the total in each bin was actually inspected. The amount taken out of each bin for inspection was then weighed in order to arrive at an accurate percentage of sort-outs in each bin.

SUMMARY

Culls, wire worm and grub injury, and cuts and bruises composed the greater part of the sort-outs. The figures being respectively 5.59%, 4.67% and 3.14%, or a total of 13.40% for these three classes alone. Comparing this figure with the calculated total of 14.44% sort-outs, it can readily be seen what the bulk of the sort-outs included.

The 14.44% of sort-outs represents the percentage of total sort-outs removed from the total weight inspected. Of the fifteen lots examined, the lowest percentage of sort-outs was 9.36% while the highest was 27.16%, showing a variation of 17.80% between the two extremes. Three lots ran above 20%; ten of the fifteen lots ranged within approximately 3.00% of the calculated 14.44%. On the face of these results, it is therefore reasonable to assume that 14.44% of sort-outs represents a fair average for the entire amount in storage. In making these comparisons it should be remembered that the lots inspected represented amounts of from one to fifteen crates.

The standard followed thruout this inspection was the same that is required of seed growers in other sections of the state where certified seed is produced. By removing 14.44% of sort-outs from this stock it would still be, in my opinion, a very mediocre lot of certified seed when compared to Pennsylvania certified seed potatoes in general.

Report on Condition of Potatoes in Experimental Storage in The Marble Laboratory at Canton, Pa., when Stock was Removed from Storage

When the experimental storage period was ended, which the members of the Committee had previously decided should be about May 1st, the Department of Agriculture was requested to make a series of observations and records on the condition of the various lots at that time, so that comparisons could be made of the effect of the diverse holding conditions on such features as rots, sprouting, sweating, etc.

At this time also, representative samples were taken from the various lots for planting tests, to determine whether the variations in storage conditions might bring about differences in germination, growth, vigor or yield. A separate report is presented on the result of these tests.

As before, this work was carried out by K. W. Lauer with the assistance of Mr. Marble's own staff and in particular of Mr. R. B. Maxwell. The storage was broken and records made in the period April 28 to May 5, 1925. Mr. Lauer's report is here given.

The observations were made according to instructions from W. A. McCubbin, Chief Plant Pathologist of the Bureau of Plant Industry, Harrisburg, Pa. The following is a copy of the instructions:

PROPOSED METHOD OF EXAMINATION OF CANTON STORAGE SEED POTATOES WHEN STORAGE IS ENDED

Time—May 1 (or April 27 to May 5).

Assigned to carry out observations—K. W. Lauer and R. C. Test.

Samples:

Bins—Samples from top foot, middle foot and bottom foot. Take whole layer off into crates and select 5 bushels for counts. Take down to 5 foot layer and repeat; take down to 1 foot layer and repeat.

General Statement on conditions should include:

(a) Sweating or moisture
(b) Sprouting
(c) Molds
(d) Shriveling

Sorting percentages:

1. Graded certified seed
2. Rots:
   (a) Inactive
   (b) Active
3. Suberized cuts and bruises
4. Shriveled
5. Culls (wireworm, scab, grub, sunburn, ill-shapen, etc.)

Bags to be inspected in same way. using at least 10% of total quanity or at least two bags.

Crates in same manner as bags or at least 5 crates.

Samples for test plots:

Standard sample of 40 pounds; those except as noted below to be taken from those graded to certification standards.

Three samples to be taken from each bin:

(a) Top Foot
(b) Middle Foot
(c) Bottom Foot

A sample from Potter County stock from bags and crates in each room.

Three samples from bin and one from crates in bank storage cellar.

One sample badly shriveled tubers.

One sample badly sprouted.

One sample badly rotted.

One sample with small rot spots.

One of tubers wet thruout storage.

One of unsprouted tubers.

The following results were secured by dumping the potatoes on a sorting table and examining practically each potato individually.

ROOM NO. 1. ONE AIR CHANGE PER HOUR.

BULK STORAGE (top foot)

BIN NO. 1. 8 foot bin. Potter County Russets.

Date removed from storage: April 28, 1925

Condition—General Statement:

(a) Sweating:
Tubers moist for about two tubers deep, except around front and side of bin and over the immediate surface.

(b) Sprouting:
Sprouts up to 3 inches long

(c) Molds:
Few active molds

(d) Shriveling:
Few tubers are soft but very few are shriveled

BIN NO. 1. ONE AIR CHANGE PER HOUR. 8 foot bin. Potter County Russets.

BULK STORAGE (middle foot):

Date removed from storage: April 28, 1925

Condition—General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to two inches

(c) Molds:
Few active molds

(d) Shriveling:
Tubers fairly firm

BULK STORAGE (bottom foot):

Date removed from storage: April 28, 1925

Condition—General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ⅛ inch

(c) Molds:
No molds.

(d) Shriveling:
Tubers shriveled around front and sides and for about six inches from the bottom of the bin. This bin has a slatted floor.

CRATE STORAGE:

Date: April 28, 1925

General Statement:

Potter County Russets:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 1 inch

(c) Molds:
Few active molds

(d) Shriveling:
Tubers soft and shriveled

Irish Cobblers:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ½ inch

(c) Molds:
No molds

(d) Shriveling:
Tubers soft

Green Mountains:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ½ inch

(c) Molds:
No molds

(d) Shriveling:
Tubers firm

Sir Walter Raleighs:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers quite firm

Michigan Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers soft. Few shriveled

Bradford County Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers soft

BAG STORAGE:
Date: April 28, 1925
General Statement:
Potter County Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch

(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Irish Cobblers:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers quite firm

Green Mountains:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts very faintly active
(c) Molds:
No molds
(d) Shriveling:
Tubers firm

Sir Walter Raleighs:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts just starting
(c) Molds:
No molds
(d) Shriveling:
Tubers not shriveled but slightly soft

Michigan Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts just starting activity

(c) Molds:
No molds
(d) Shriveling:
Tubers soft. Few shriveled

Bradford County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft, but no shriveling

ROOM NO. 2. TWO AIR CHANGES PER HOUR.
BULK STORAGE (top foot):
BIN NO. 2. 8 foot bin. Potter County Russets.
Date removed from storage: April 29, 1925
Condition—General Statement:
(a) Sweating:
Tubers moist for about 8 inches deep except over the immediate surface and around the sides
(b) Sprouting:
Sprouts up to 3½ inches
(c) Molds:
Few active molds
(d) Shriveling:
Tubers slightly soft with few shriveled tubers

BULK STORAGE (middle foot):
Date removed from storage: April 29, 1925
Condition:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2½ inches long
(c) Molds:
No active molds
(d) Shriveling:
Tubers slightly soft

BULK STORAGE (bottom foot):
Date removed from storage May 2, 1925
Potter County Russets:
Condition:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No active molds
(d) Shriveling:
Tubers soft and shriveled

CRATE STORAGE:
Date removed from storage April 28, 1925
Potter County Russets:
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
Few active molds
(d) Shriveling:
Tubers soft and many shriveled

Irish Cobblers:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers soft

Green Mountains:
(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts very faintly active
(c) Molds:
No molds
(d) Shriveling:
Tubers firm, few soft

Sir Walter Raleighs:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers fairly firm

Michigan Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
Few active molds
(d) Shriveling:
Tubers soft, some shriveled

Bradford County Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

BAG STORAGE:

Date removed from storage: April 28, 1925

Condition—General Statement:

Potter County Russets:

(a) Sweating:
Tubers wet from the many wet rots
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers soft

Irish Cobblers:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers soft

Green Mountains:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts very faintly active
(c) Molds:
No mo'ds
(d) Shriveling:
Tubers firm

Sir Walter Raleighs:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch

(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Michigan Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts just starting
(c) Molds:
No molds
(d) Shriveling:
Tubers soft, few shriveled

Bradford County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1/8 inch
(c) Molds:
No molds
(d) Shriveling:
Tubers soft

ROOM NO. 3. THREE AIR CHANGES PER HOUR.
BULK STORAGE (top foot):
BIN NO. 3. 8 foot bin. Potter County Russets.
Date removed from storage: April 29, 1925.
Condition—General Statement:
(a) Sweating:
Tubers moist for about one tuber deep except over the immediate surface and around the sides.
(b) Sprouting:
Sprouts up to 2½ inches
(c) Molds:
Few active molds
(d) Shriveling:
Tubers slightly soft, with few shriveled tubers

BULK STORAGE (middle foot):
Date: April 30, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1¾ inch
(c) Molds:
No active molds
(d) Shriveling:
Tubers soft but not shriveled

BULK STORAGE (bottom foot):
Date: May 21, 1925
Condition:
Potter County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¾ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers soft and shriveled

CRATE STORAGE:
Date: April 28, 1925
Condition—General Statement:
Potter County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¾ inch
(c) Molds:
Few active molds
(d) Shriveling:
Tubers soft, many shriveled

Irish Cobblers:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1¼ inch
(c) Molds:
No molds
(d) Shriveling:
Few tubers soft

Green Mountains:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers quite firm

Sir Walter Raleighs:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Michigan Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
Few active mo'ds
(d) Shriveling:
Tubers soft, few tubers shriveled

Bradford County Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No active molds
(d) Shriveling:
Tubers soft, few shriveled

BAG STORAGE:
General Statement:
Potter County Russets:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch
(c) Molds:
No active molds
(d) Shriveling:
Tubers soft and few shriveled

Irish Cobblers:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Green Mountains:

(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers fairly firm

Sir Walter Raleighs:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts just starting

(c) Molds:
No molds

(d) Shriveling:
Tubers quite firm

Michigan Russets:

(a) Sweating:
Few tubers that were in contact with wet rots were wet. No signs of sweating.

(b) Sprouting:
Sprouts up to ⅛ inch

(c) Molds:
No molds

(d) Shriveling:
Tubers soft and few shriveled

Bradford County Russets:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ¼ inch

(c) Molds:
No molds

(d) Shriveling:
Tubers slightly soft

ROOM NO. 4. FOUR AIR CHANGES PER HOUR.
BULK STORAGE (top foot):
BIN NO. 4. 8 foot bin. Potter County Russets.
Date: April 30, 1925
Room Temperature:
Maximum 49
Minimum 42
Relative Humidity: 66-82%
Condition—General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 7½ inches

(c) Molds:
Few active molds

(d) Shriveling:
Excessively shriveled

BULK STORAGE (middle foot):
BIN NO. 4. Potter County Russets.
Date: April 30, 1925
Condition—General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 3 inches

(c) Molds:
No molds

(d) Shriveling:
Tubers soft and shriveled

BULK STORAGE (bottom foot):
Date: May 2, 1925
Condition—General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ¾ inch

(c) Molds:
No molds
(d) Shriveling:
Tubers excessively shriveled

ROOM NO. 4. FOUR AIR CHANGES PER HOUR.
BULK STORAGE (upper foot):
BIN NO. 5. 6 foot bin. Potter County Russets.
Date: April 30, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2 inches
(c) Molds:
No active molds
(d) Shriveling:
Tubers slightly soft and shriveled

BULK STORAGE (middle foot):
Date: April 30, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft and shriveled

BULK STORAGE (bottom foot):
BIN NO. 5. Potter County Russets
Date: May 2, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch

(c) Molds:
No active molds
(d) Shriveling:
Tubers soft and shriveled

ROOM NO. 4. FOUR AIR CHANGES PER HOUR.
BULK STORAGE (upper foot):
BIN NO. 6. 3 foot upper bin. Potter County Russets.
Date: April 30-31, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1¼ inch
(c) Molds:
No active molds
(d) Shriveling:
Tubers soft and slightly shriveled

BULK STORAGE (middle foot):
Date: May 2, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¾ inch
(c) Molds:
No active molds
(d) Shriveling:
Tubers quite firm

BULK STORAGE (lower foot):
Date: May 2, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch

(c) Molds:
No active molds
(d) Shriveling:
Tubers soft, few shriveled

ROOM NO. 4. FOUR AIR CHANGES PER HOUR.
BULK STORAGE (upper foot):
BIN NO. 7. 3 foot lower bin.
Date: May 2, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft, few shriveled

BULK STORAGE (middle foot):
Date: May 2, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers shriveled slightly

BULK STORAGE (bottom foot):
Date: May 2, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch

(c) Molds:
No molds
(d) Shriveling:
Tubers excessively shriveled

CRATE STORAGE:
Date: April 29, 1925
General Statement:
Potter County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2 inches
(c) Molds:
No molds
(d) Shriveling:
Tubers shriveled and quite soft

Irish Cobblers:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2½ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Green Mountains:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2½ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers very slightly soft

Sir Walter Raleighs:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 3 inches
(c) Molds:
No molds
(d) Shriveling:
Tubers fairly solid

Michigan Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2½ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers soft and shriveled

Bradford County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1½ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers very soft, some shriveled

BAG STORAGE:
Date: April 29, 1925
General Statement:
Potter County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2 inches
(c) Molds:
No molds

(d) Shriveling:
Tubers soft and shriveled

Irish Cobblers:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 2½ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Green Mountains:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1½ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Sir Walter Raleighs:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1¼ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft

Michigan Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1¼ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers soft and shriveled

Bradford County Russets:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 1½ inches

(c) Molds:
No molds

(d) Shriveling:
Tubers firm

ROOM NO. 5. UNVENTILATED.
BULK STORAGE (upper foot):
BIN NO. 8. 8 foot bin. Potter County Russets.
Date: April 30, 1925
Room Temperature:
Maximum: 51 degrees F.
Minimum: 50 degrees F.
Relative Humidity: 80% saturated.
Condition—General Statement:

(a) Sweating:
Tubers wet for about 6 inches deep

(b) Sprouting:
Sprouts up to 6 inches

(c) Molds:
No molds

(d) Shriveling:
Tubers very soft and shriveled

BULK STORAGE (middle foot):
Date: May 2, 1925
General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 7½ inches

(c) Molds:
No molds

(d) Shriveling:
Tubers slightly soft

BIN NO. 8.
Date: May 2, 1925
BULK STORAGE (lower foot):
Condition—General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 5½ inches

(c) Molds:
No molds

(d) Shriveling:
Tubers soft and shriveled

ROOM NO. 5. UNVENTILATED.
BULK STORAGE (top foot):
BIN NO. 9. 8 foot bin. Sir Walter Raleighs.
Date: May 2, 1925
Condition—General Statement:

(a) Sweating:
Tubers wet, except over the immediate surface of the bin and around the sides.

(b) Sprouting:
Sprouts up to 7 inches

(c) Molds:
Few active molds

(d) Shriveling:
Tubers quite firm

BULK STORAGE (middle foot):
Date: May 2, 1925
Condition—General Statement:
Sir Walter Raleighs:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 6½ inches

(c) Molds:
No active molds

(d) Shriveling:
Tubers quite firm

BULK STORAGE (bottom foot):
Date: May 4, 1925
Condition—General Statement:
Sir Walter Raleighs:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 4¼ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers firm

ROOM NO. 5. UNVENTILATED.
BULK STORAGE (top foot):
BIN NO. 10. 7 foot bin. Irish Cobblers.
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers moist
(b) Sprouting:
Sprouts up to 5½ inches
(c) Molds:
No molds
(d) Shriveling:
Tubers firm, few soft

BULK STORAGE (middle foot):
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 7 inches
(c) Molds:
No molds
(d) Shriveling:
Tubers excessively shriveled

BULK STORAGE (bottom foot):
BIN NO. 10.
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 5 inches
(c) Molds:
No molds
(d) Shriveling
Tubers soft

ROOM NO. 5. UNVENTILATED.
BULK STORAGE (upper foot):
BIN NO. 11. 8 foot bin. Bradford County Russets.
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 7 inches
(c) Molds:
Few active molds
(d) Shriveling

BULK STORAGE (middle foot):
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 10 inches
(c) Molds:
No molds
(d) Shriveling
Tubers slightly soft

BULK STORAGE (lower foot):
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 6 inches
(c) Molds:
No active molds
(d) Shriveling
Tubers firm

ROOM NO. 5. UNVENTILATED.
BULK STORAGE (upper foot):
BIN NO. 12. 6 foot bin. Green Mountains
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers wet for 18 inches deep except over the immediate surface and around the sides.
(b) Sprouting:
Sprouts up to 11½ inches
(c) Molds:
No active molds
(d) Shriveling
Tubers soft and slightly shriveled

BULK STORAGE (middle foot):
BIN NO. 12.
Date: May 4, 1925
Condition:
Green Mountains:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 9¼ inches
(c) Molds:
No active molds
(d) Shriveling
Tubers soft

BULK STORAGE (bottom foot):
Date: May 5, 1925
Condition:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 5 inches
(c) Molds:
No molds
(d) Shriveling
Tubers firm

ROOM NO. 5. UNVENTILATED.
BULK STORAGE (upper foot):
BIN NO. 13. 8 foot bin. Michigan Russets.
Date: May 4, 1925
Condition—General Statement:
(a) Sweating:
Tubers wet for about 5 tubers deep. The immediate surface and sides of the bin are dry.
(b) Sprouting:
Sprouts up to 5½ inches
(c) Molds:
Few active molds
(d) Shriveling

BULK STORAGE (middle foot):
Date: May 4, 1925
Condition:
Michigan Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 11½ inches
(c) Molds:
No active molds
(d) Shriveling
Tubers soft

BULK STORAGE (bottom foot):
Date: May 5, 1925
Condition:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 4 inches

(c) Molds:
No molds

(d) Shriveling
Tubers slightly soft

CRATE STORAGE:
Date: April 29, 1925
General Statement:
Potter County Russets:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 1 inch

(c) Molds:
Few active molds

(d) Shriveling
Tubers soft and slightly shriveled

Irish Cobblers:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 1½ inches

(c) Molds:
No active molds

(d) Shriveling
Tubers firm

Green Mountains:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ¼ inch

(c) Molds:
No molds

(d) Shriveling
Tubers quite firm

Sir W lter Raleighs:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to 1¼ inch

(c) Molds:
No active molds

(d) Shriveling
Tubers firm

Michigan Russets:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ¼ inch

(c) Molds:
Few active molds

(d) Shriveling
Tubers quite firm

Bradford County Russets:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to ¾ inch

(c) Molds:
No active molds

(d) Shriveling
Tubers quite firm

BAG STORAGE:
Date: April 29, 1925
General Statement:
Potter County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling
Tubers fairly firm
Irish Cobblers:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling
Tubers slightly soft
Green Mountains:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers firm
Sir Walter Raleighs:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ⅛ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers firm

Michigan Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers very soft and shriveled
Bradford County Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to ½ inch
(c) Molds:
No molds
(d) Shriveling:
Tubers slightly soft
CELLAR STORAGE:
BIN NO. 14. Potter County Russets.
Date: April 27, 1925
Room Temperature:
Maximum: 50 degrees F.
Minimum: 50 degrees F.
Relative Humidity: 75% saturated
BULK STORAGE (top foot):
Date removed from storage: April 27, 1925
Condition—General Statement:
(a) Sweating:
Tubers moist for about 1 foot deep. Below the upper foot the potatoes were dry.
(b) Sprouting:
Sprouts up to ¼ inch
(c) Molds:
Few active molds
(d) Shriveling:
Shriveled tubers found mostly along the front and sides of the bin

OLD CELLAR:
BULK STORAGE (middle foot):
General Statement:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts up to about 1/8 inch

(c) Molds:
No active molds

(d) Shriveling:
Tubers solid, except around side and in the corners, where the tubers are less firm than in the center of the bin. Tubers along the front are soft and shriveled considerably.

OLD CELLAR:
BULK STORAGE (bottom foot):
General Statement:

(a) Sweating:
Tubers dry except a small area toward the door, where there are signs of frost injury.

(b) Sprouting:
Sprouts just starting

(c) Molds:
No active molds

(d) Shriveling:
Tubers shriveled excessively thruout the lower foot. These potatoes were stored on a concrete floor.

CRATE STORAGE:
General Statement:
Potter County Russets:

(a) Sweating:
Tubers dry

(b) Sprouting:
No sprouts

(c) Molds:
Few active molds

(d) Shriveling:
There appeared to be a very large per cent of shriveled tubers.

OPEN CELLAR:
CRATE STORAGE: Home grown.
Date: May 5, 1925
General Statement:
Green Mountains:

(a) Sweating:
Tubers dry

(b) Sprouting:
No sprouts

(c) Molds:
No molds

(d) Shriveling:
Tubers firm

OPEN CELLAR:
CRATE STORAGE: Home grown.
General Statement:
Irish Cobblers:

(a) Sweating:
Tubers dry

(b) Sprouting:
Sprouts close to 1/8 inch

(c) Molds:
No molds

(d) Shriveling:
Tubers firm

OPEN CELLAR:
CRATE STORAGE: Home grown.
General Statement:
Bliss Triumph:

(a) Sweating:
Tubers dry

(b) Sprouting:
No sprouts

(c) Molds:
No molds
(d) Shriveling:
Tubers firm

OPEN CELLAR:
CRATES: Early Ohio, home grown.
General Statement:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1/8 inch
(c) Molds:
No molds
(d) Shriveling:
Tubers firm

OPEN CELLAR:
CRATES: Home grown.
General Statement:
Russets:
(a) Sweating:
Tubers dry
(b) Sprouting:
Sprouts up to 1/4 inch
(c) Molds:
No molds
(d) Shriveling:
Tubers firm

DATA ON ALL STOCK STORED IN ROOM NO. 1, BIN NO. 1

Variety	Type of Storage*	Part of Bin**	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
				Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Potter Russets	bk.	T	277.00	243.5	87.90	19.25	6.94			0.50	.18	2.75	.99	11.0	3.97
" "	"	M	278.50	225.0	80.79	24.25	8.70	6.5	2.33	2.50	.89	2.25	.80	18.0	6.46
" "	"	B	291.0	225.0	77.31	5.5	1.89	3.5	1.20	6.0	2.06	35.0	12.02	16.0	5.49
" "	"	Tl.	846.5	693.5	81.92	49.0	5.78	10.0	1.18	9.0	1.06	40.0	4.72	45.0	5.30
" "	c.		265.5	205.0	77.25	9.0	3.38	4.0	1.50	5.5	2.07	19.0	7.15	23.0	8.66
" "	bg.		261.5	220.0	84.13	21.5	8.22	2.0	.76	3.0	1.14	7.5	2.86	7.5	2.86
Sir W. Raleighs	c.		104.0	85.0	81.73	3.75	3.60	3.0	2.88	6.25	6.00			6.0	5.76
" " "	bg.		55.25	50.0	90.49	2.5	4.52			1.5	2.71			1.25	2.26
Cobbler	c.		109.50	96.0	87.67	0.50	.45	4.0	3.65	4.50	4.10	.50	.45	4.0	3.65
"	bg.		57.25	45.0	78.60	1.5	2.62	2.5	4.36	6.75	11.79			1.5	2.62
Brad. Russets	c.		96.50	84.0	87.04	2.25	2.33	1.25	1.29	4.5	4.66	2.0	2.07	2.5	2.59
" "	bg.		55.25	46.0	83.25	2.25	4.07	1.0	1.80	4.75	8.59			1.25	2.26
Mich. Russets	c.		96.0	80.0	83.33	1.5	1.56	4.0	4.16	2.5	2.60	7.0	7.29	1.0	1.04
" "	bg.		50.00	43.0	86.0	1.25	2.50	1.0	2.0	1.75	3.50	2.25	4.50	.75	1.50
Green Mts.	c.		104.25	85.0	81.53	1.0	.95	6.0	5.75	5.5	5.27	0.25	.23	6.5	6.23
" "	bg.		71.50	61.5	86.01	.75	1.04	.50	.69	4.0	5.59			4.75	6.64

DATA ON ALL STOCK STORED IN ROOM NO. 2, BIN NO. 2

Variety	Type of Storage*	Part of Bin**	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
				Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Potter Russets	bk.	T	271.25	230.0	84.8	21.0	7.75	5.5	2.02	1.25	.45	2.5	.92	11.0	4.02
" "	"	M	304.0	256.0	84.25	23.5	7.73	6.5	2.13	5.0	1.65	3.0	.98	10.0	3.29
" "	"	B	296.5	205.0	69.15	18.0	6.07	7.5	2.52	4.0	1.35	41.0	13.83	21.0	7.08
" "	"	Tl.	871.75	691.0	79.26	62.5	7.16	19.5	2.23	10.25	1.18	46.5	5.33	42.0	4.81
" "	c.		261.5	198.0	75.35	16.0	6.12	6.0	2.29	0.5	.57	31.0	11.85	10.0	3.82
" "	bg.		252.0	190.0	75.39	29.0	11.50	9.0	3.57	3.5	1.38	8.5	3.37	12.0	4.76
Sir W. Raleighs	c.		95.5	86.0	90.05	3.5	3.66	.5	.52	1.5	1.57			4.0	4.19
" " "	bg.		54.25	50.00	92.1	1.75	3.24			1.5	2.76			1.0	1.84
Cobblers	c.		112.50	100.0	88.88	0.5	.44	3.0	2.66	5.5	4.88	2.0	1.77	1.5	1.33
"	bg.		55.25	49.0	88.68			1.5	2.73	3.75	6.78			1.0	1.80
Brad. Russets	c.		98.75	85.25	86.40	3.0	3.08	2.0	2.02	4.5	4.53	4.0	4.02		
" "	bg.		51.25	46.0	89.7	0.25	.48	1.5	2.95	1.5	2.95	1.0	1.95	1.0	1.95
Mich. Russets	c.		104.25	86.0	82.50	3.50	3.36	4.50	4.37	.75	.71	6.5	6.23	3.0	2.88
" "	bg.		48.25	42.0	87.0	0.5	1.03	2.0	4.14	.25	.51	1.75	3.65	1.75	3.65
Green Mts.	c.		98.5	84.0	85.27	1.5	1.52	1.5	1.52	3.5	3.55	1.0	1.01	7.0	7.1
" "	bg.		64.5	56.0	86.82	1.5	2.32	.75	1.16	3.25	5.03	1.25	1.93	1.75	2.73

DATA ON ALL STOCK STORED IN ROOM NO. 3, BIN NO. 3

Variety	Type of Storage*	Part of Bin**	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
				Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Potter Russets	bk.	T	289.0	242.0	83.8	26.5	9.17	6.5	2.25	1.75	.6	4.25	1.47	8.0	2.77
" "	"	M	285.0	240.0	84.21	18.0	6.31	10.0	3.51	7.5	2.63	1.5	.52	8.0	2.80
" "	"	B	284.5	220.0	77.32	9.5	3.34	7.5	2.63	4.5	1.58	31.0	10.85	12.0	4.22
" "	"	Tl.	858.5	702.0	81.77	54.0	6.29	24.0	2.79	13.75	1.60	36.75	4.28	28.0	3.26
" "	c.		264.25	203.0	76.8	15.5	5.86	4.5	1.74	4.25	1.59	24.5	9.27	12.5	4.73
" "	bg.		284.0	250.0	88.02	10.5	3.69	3.0	1.05	2.0	.7	12.5	4.40	6.0	2.11
Sir W. Raleighs	c.		98.5	89.5	90.85	2.0	2.03	0.5	.5	3.0	3.04			3.5	3.54
" " "	bg.		54.0	50.0	92.6	1.25	2.33			1.5	2.78	1.25	2.33		
Cobblers	c.		109.75	97.5	88.85			2.0	1.82	6.5	5.92	1.0	.91	2.75	2.50
"	bg.		54.5	50.0	91.74					2.25	4.13	1.5	2.75	.75	1.37
Brad. Russets	c.		91.0	79.0	86.85	1.25	1.37	2.0	2.19	3.0	3.29	5.5	6.04	.25	.27
" "	bg.		52.5	45.0	85.75	.5	.95	2.25	4.29	3.5	6.67	.5	.95	.75	1.43
Mich. Russets	c.		100.0	83.0	83.0	2.0	2.0	5.5	5.5	1.0	1.0	6.5	6.5	2.0	2.0
" "	bg.		46.25	40.0	86.5	1.75	3.8	.5	1.08	.75	1.61	3.0	6.48	.25	.54
Green Mts.	c.		63.5	57.0	89.85	.5	.78	1.25	1.97	2.25	3.50	1.0	1.57	1.5	2.36
" "	bg.		91.0	77.0	84.61	1.75	1.92	1.75	1.92	6.0	6.58	.5	.54	4.0	4.38

DATA ON ALL STOCK STORED IN ROOM NO. 4, BINS NOS. 4, 5, 6 AND 7
POTTER COUNTY RUSSETS

Bin Number (Bulk Storage)	Part of Bin**	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
			Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
4	T	306.5	232.0	75.65	15.0	4.95	5.0	1.61	5.5	1.80	39.0	12.75	10.0	3.22
4	M	273.0	204.0	74.75	19.0	6.96	11.5	4.15	7.0	2.56	13.5	4.95	18.0	6.59
4	B	291.5	175.0	60.03	9.0	3.08	7.0	2.40	2.5	.85	92.0	31.56	6.0	2.06
4	Tl.	871.0	611.0	70.14	43.0	4.93	23.5	2.69	15.0	1.72	144.5	16.59	34.0	3.94
5	T	305.5	235.0	76.92	16.0	5.23	5.0	1.63	26.5	8.67	12.0	3.92	11.0	3.60
5	M	285.0	239.0	83.85	11.5	4.03	10.5	3.68	5.0	1.78	4.0	1.40	15.0	5.27
5	B	227.5	192.0	84.39	15.0	6.59	6.0	2.63	1.5	.66			13.0	5.71
5	Tl.	818.0	666.0	81.41	42.5	5.19	21.5	2.62	33.0	4.03	16.0	1.95	39.0	4.76
6	T	287.0	238.0	83.00	14.5	5.05	8.0	2.78	7.5	2.61	9.0	3.13	10.0	3.48
6	M	282.5	247.0	87.49	12.0	4.24	4.5	1.59	8.0	2.83	2.5	.88	8.5	3.01
6	B	293.0	248.0	84.64	12.5	4.26	9.0	3.07	5.5	1.87	4.5	1.54	13.5	4.60
6	Tl.	861.5	733.0	85.08	39.0	4.52	21.5	2.49	21.0	2.43	16.0	1.85	31.0	3.59
7	T	298.5	245.0	82.07	15.5	5.19	11.0	3.68	2.5	.83	7.5	2.49	17.0	5.69
7	M	286.5	226.0	78.88	12.5	4.35	11.5	4.01	5.5	1.91	22.0	7.68	9.0	3.14
7	B	281.0	196.0	69.71	8.5	3.02	10.0	3.55	1.5	.53	55.0	19.58	10.0	3.55
7	Tl.	866.0	667.0	77.02	36.5	4.21	32.5	3.75	9.5	1.09	84.5	9.75	36.0	4.15

DATA ON ALL STOCK STORED IN CRATES AND BAGS IN ROOM NO. 4

Variety	Type of Storage*	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
			Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Potter Russets	c.	258.5	203.0	78.6	12.5	4.84	5.0	1.93	1.0	.38	29.5	11.4	7.5	2.9
Sir W. Raleighs	c.	90.5	83.0	91.75	2.5	2.76	.5	.55	3.0	3.31			1.5	1.65
Cobblers	c.	111.0	101.0	90.99	.5	.45	1.5	1.35	4.75	4.28	1.75	1.57	1.5	1.35
Brad. Russets	c.	95.25	78.0	81.9	2.5	2.65	2.	2.11	5.5	5.78	4.25	4.46	3.0	3.15
Mich. Russets	c.	23.25			1.0	4.31	5.0	21.55	3.25	13.97	12.5	53.78	1.5	6.45
Green Mts.	c.	95.5	86.0	90.05			.5	.52	6.5	6.81	.25	.26	2.25	2.36
Potter Russets	bg.	241.0	186.0	77.2	18.0	7.47	5.0	2.07	1.5	.62	26.5	10.98	4.0	1.66
Sir W. Raleighs	bg.	3.0			1.5	50.0			1.0	33.33	.25	8.33	.25	8.33
Cobblers	bg.	52.25	47.0	89.95	.25	.47	.5	.95	3.5	6.69	.5	.95	.5	.95
Brad. Russets	bg.	51.5	46.5	90.29	1.0	1.94			3.0	5.82			1.0	1.94
Mich. Russets	bg.	12.5			3.0	24.0	1.5	12.0	2.5	20.0	5.5	44.0		
Green Mts.	bg.	71.0	57.0	80.3	3.5	4.93	2.0	2.82	6.0	8.45	1.0	1.4	1.5	2.1

DATA ON ALL STOCK STORED IN ROOM NO. 5, BINS NOS. 8, 9. 10 AND 11

Variety	Bin No. (Bulk Storage)	Part of Bin**	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
				Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Potter Russets	8	T	280.5	218.0	77.79	27.0	9.51	13.0	4.66	3.5	1.25	14.5	5.1	4.5	1.65
" "	8	M	290.0	249.5	86.03	15.5	5.34	8.5	2.96	2.5	.80	3.5	1.20	10.5	3.62
" "	8	B	290.0	222.0	76.59	14.0	4.82	15.0	5.17	1.0	.34	27.0	9.32	11.0	3.79
" "	8	Tl.	860.5	689.5	80.12	56.5	6.56	36.5	4.24	7.0	.81	45.0	5.22	26.0	3.02
Sir W. Raleighs	9	T	287.0	260.0	90.59	10.5	3.66	5.0	1.74	6.0	2.09	0.5	.17	5.0	1.74
" " "	9	M	292.5	258.0	88.25	9.5	3.24	2.5	.85	8.0	2.73	1.5	.51	13.0	4.44
" " "	9	B	285.0	270.0	94.75	7.0	2.45	.5	.17	4.5	1.57			3.0	1.05
" " "	9	Tl.	864.5	788.0	91.15	27.0	3.12	8.0	.92	18.5	2.13	2.0	.23	21.0	2.42
Cobblers	10	T	296.5	249.0	84.0	6.0	2.02	20.5	6.91	10.5	3.54	3.0	1.01	7.5	2.53
"	10	M	281.5	218.5	77.6	5.0	1.77	3.0	1.06	13.0	4.62	28.5	10.13	13.5	4.79
"	10	B	288.0	260.0	90.33	1.0	.34	4.0	1.38	12.5	4.34	3.5	1.21	7.0	2.43
"	10	Tl	866.0	727.5	84.0	12.0	1.38	27.5	3.17	36.0	4.15	35.0	4.04	28.0	3.23
Brad. Russets	11	T	284.5	233.0	81.9	9.5	3.34	14.0	4.92	21.0	7.38	2.5	.87	4.5	1.58
" "	11	M	284.0	258.0	90.88	3.5	1.23	3.5	1.23	16.5	5.80	.5	.17	2.0	.70
" "	11	B	285.0	255.0	89.5	5.0	1.75	5.0	1.75	19.0	6.67			1.0	.35
" "	11	Tl.	853.5	746.0	87.52	18.0	2.1	22.5	2.51	56.5	6.61	3.0	.35	7.5	.87

DATA ON ALL STOCK STORED IN ROOM NO. 5, BINS NOS. 12 AND 13

Variety	Bin Number (Bulk Storage)	Part of Bin**	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
				Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Green Mts.	12	T	280.5	239.5	85.4	1.0	.35	1.0	.35	29.5	10.5	5.0	1.78	4.5	1.65
" "	12	M	274.0	245.0	89.45					24.0	8.75	1.0	.36	4.0	1.46
" "	12	B	289.75	262.0	90.42	1.5	.51	2.0	.69	19.25	6.64			5.0	1.72
" "	12	Tl.	844.25	746.5	88.42	2.5	.29	3.0	.35	72.75	8.61	6.0	.72	13.5	1.59
Mich. Russets	13	T	274.5	245.0	89.25	7.5	2.73	5.0	1.82	12.0	4.36	2.0	.72	3.0	1.09
" "	13	M	290.5	266.0	91.56	5.5	1.89	6.0	2.06	8.0	2.75	2.0	.68	3.0	1.03
" "	13	B	294.5	275.0	93.37	6.0	2.03	4.5	1.52	5.5	1.86			3.5	1.18
" "	13	Tl.	859.5	786.0	91.44	19.0	2.21	15.5	1.8	25.5	2.96	4.0	.46	9.5	1.1

DATA ON ALL STOCK STORED IN CRATES AND BAGS IN ROOM NO. 5

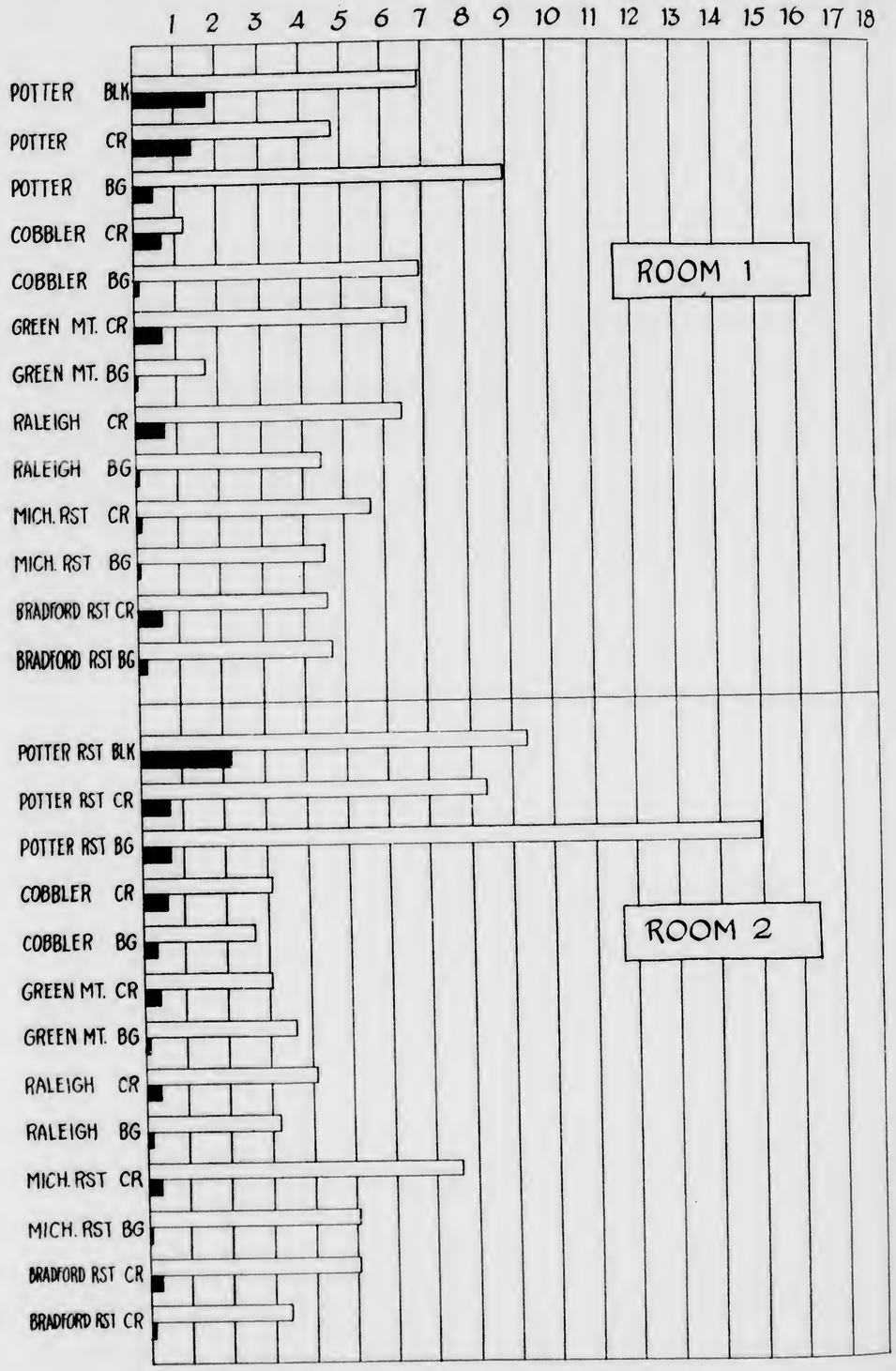
Variety	Type of Storage*	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
			Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Potter Russets	c.	267.5	223.0	83.4	19.5	7.3	8.5	3.18	5.0	1.87	6.0	2.24	5.5	2.06
Green Mts.	c.	93.0	77.5	83.33	.5	.53	5.0	5.37	8.0	8.6	.5	.53	1.5	1.59
Sir W. Raleighs	c.	113.25	102.5	90.5	4.25	3.75	2.0	1.76	3.0	2.65			1.5	1.32
Mich. Russets	c.	100.75	83.0	82.37	4.0	3.95	8.0	7.94	4.5	4.46	.25	.24	1.0	.99
Brad. Russets	c.	103.0	87.0	84.45	3.0	2.91	4.0	3.88	6.0	5.82	1.5	1.45	1.5	1.45
Cobblers	c.	102.0	89.5	87.75	2.5	2.45	3.5	3.42	4.5	4.47			2.0	1.96
Potter Russets	bg.	266.0	221.0	83.08	22.5	8.45	8.0	3.0	5.0	1.87	0.5	.18	9.0	3.38
Cobblers	bg.	54.75	48.0	87.67	1.0	1.82	3.0	5.47	1.25	2.28			1.5	2.73
Green Mts.	bg.	62.5	55.5	88.8	.5	.80	.5	.80	3.0	4.8			3.0	4.8
Sir W. Raleighs	bg.	54.5	52.0	95.41	1.0	1.83	.5	.91	.5	.91			.5	.91
Mich. Russets	bg.	49.75	43.0	86.43	1.0	2.01	3.5	7.03			1.0	2.01	1.25	2.51
Brad. Russets	bg.	55.5	47.0	84.68	2.5	4.5	2.5	4.5	3.5	6.3				

DATE ON ALL STOCK STORED IN BIN NO. 14 (CELLAR STORAGE) AND OPEN STORAGE

Variety	Type of Storage*	Part of Bin**	Total Lbs. Inspected	Graded Stock		Active Rots		Inactive Rots		Suberized Cuts		Shrivelled		Culls	
				Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%	Lbs.	%
Potter Russets	bk.	T	295.75	199.0	67.28	15.75	5.32	2.5	.84	2.0	.67	29.5	9.96	47.0	15.89
" "	"	M	290.5	227.75	78.39	5.25	1.8	.75	.25	5.5	1.89	13.75	4.72	37.5	12.9
" "	"	B	293.0	165.0	56.31	15.0	5.11	2.0	.68	8.5	2.9	76.5	26.1	26.0	8.87
" "	"	Tl.	879.25	591.75	67.32	36.0	4.07	5.25	.59	16.0	1.82	119.75	13.57	110.5	12.55
Potter Russets Open Storage	c.		212.75	94.5	44.41	22.0	10.34			.75	.35	52.5	24.67	43.0	20.21
Home-grown Green Mts.	c.		186.5	184.0	98.65					2.5	1.34				
Home-grown Cobblers	c.		156.0	154.0	98.71					2.0	1.28				
Home-grown Bliss Triumph	c.		111.0	110.0	99.09					1.0	.9				
Home-grown Early Ohio	c.		116.75	116.0	99.35					.75	.65				
Home-grown Russets	c.		98.5	95.0	96.43					3.5	3.55				

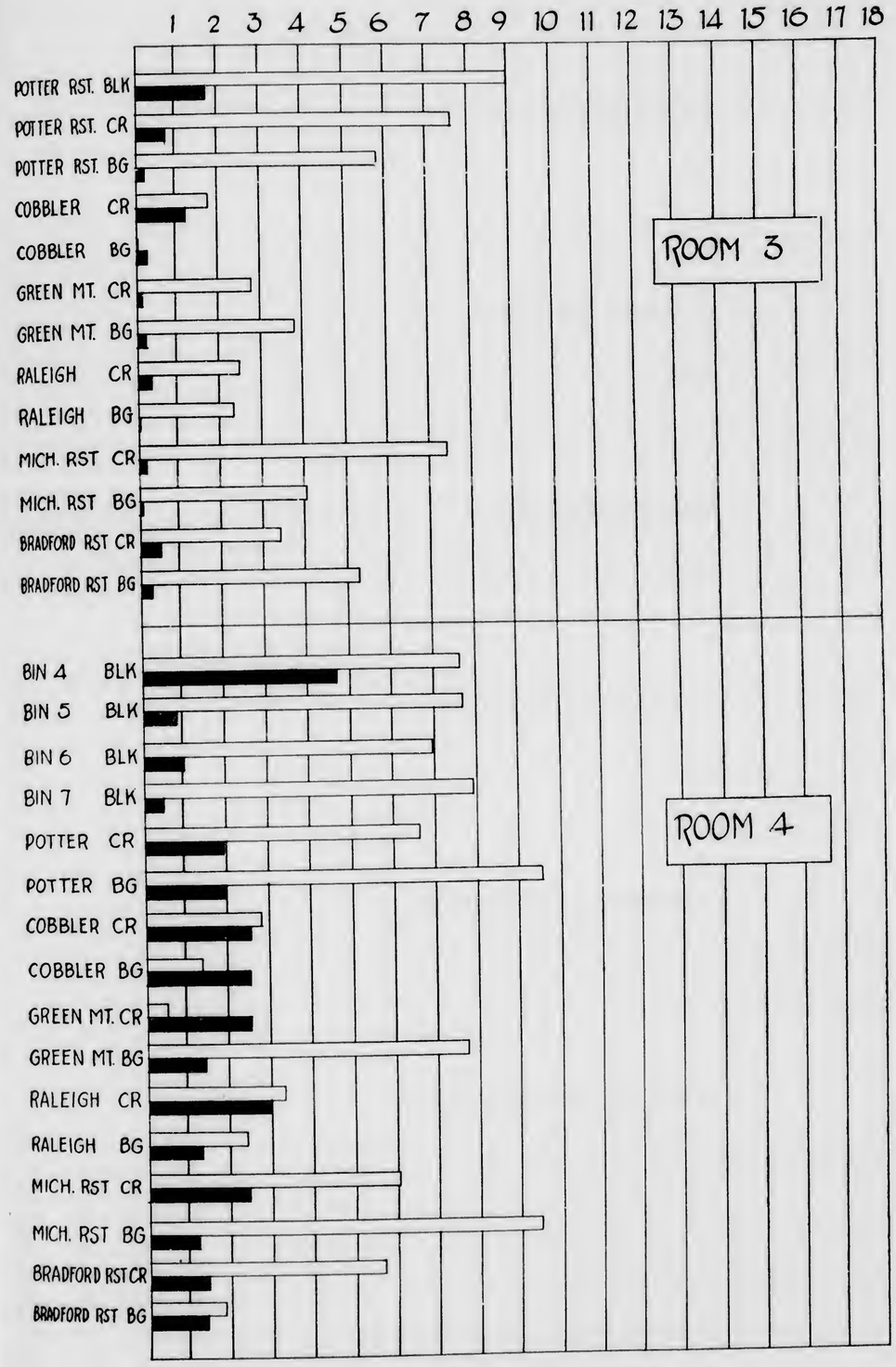
NOTE: * bk.—bulk
bg.—bag
c.—crate

** T.—top foot of bin
M.—middle foot of bin
B.—bottom foot of bin
Tl.—Total from top, middle and bottom of bin



CONDENSED TABLE OF STORAGE OBSERVATIONS.

Average length of sprouts in inches is given in white; the black represents the percentage of storage rot. Bag, crate and bulk storage are indicated by the abbreviations BG, CR, BLK, and for Russet the abbreviation RST is used.



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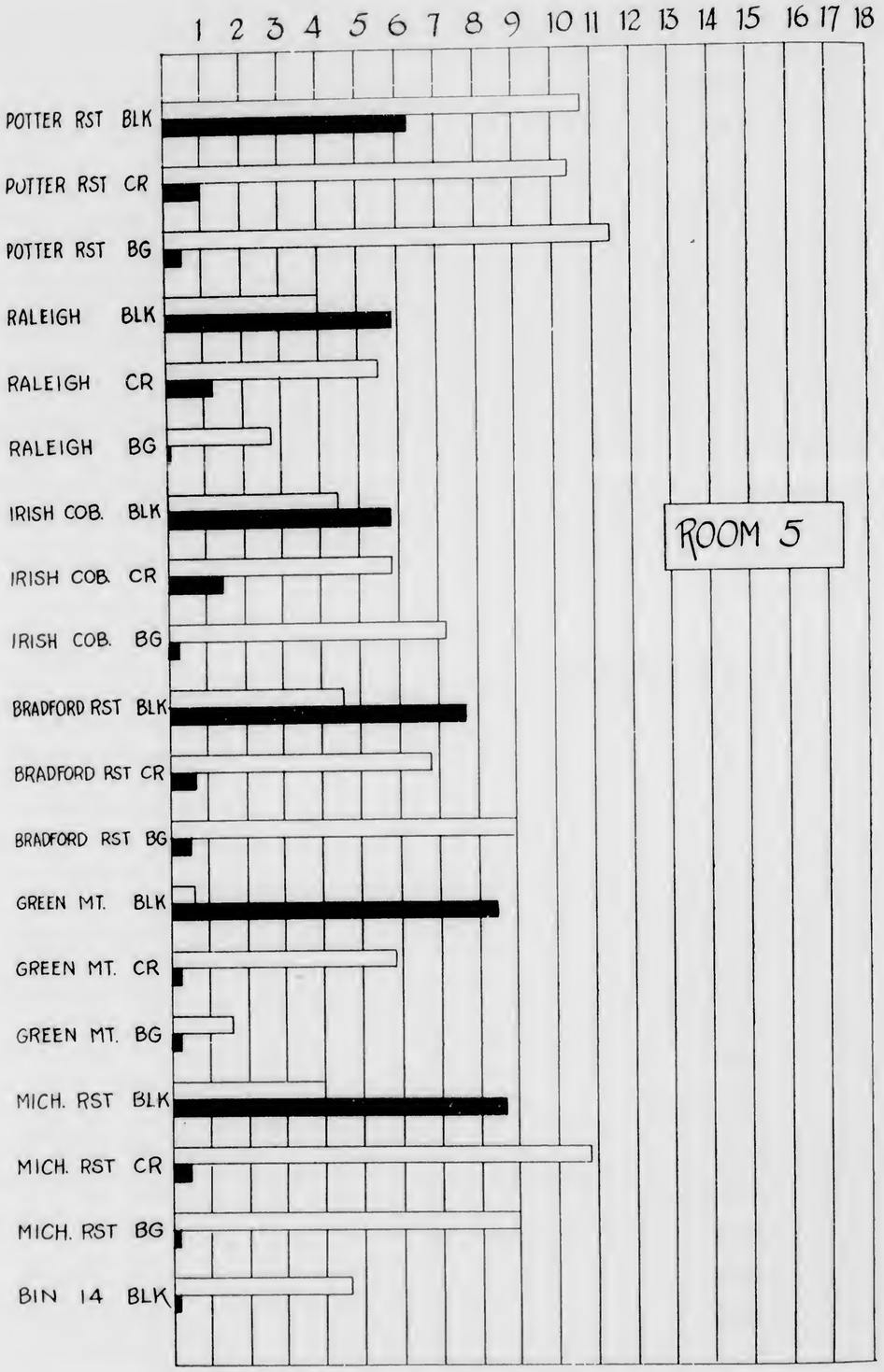


CONDENSED TABLE OF STORAGE OBSERVATIONS.

Average length of sprouts in inches is given in white; the black represents the percentage of storage rot. Bag, crate and bulk storage are indicated by the abbreviations BG, CR, BLK, and for Russet the abbreviation RST is used.

DISCUSSION

The bin that showed the most moisture over the surface thruout the storage period, showed the first signs of sprouting. Sprouting activity was first noted on January 28, 1925, in the unventilated bulk stock. Sprouting of the crate and bag stock in the unventilated room was not noted until March the 2nd. In rooms 1, 2, and 3 the bulk stock showed sprouting activity 6 to 8 weeks earlier than the stock stored in crates and bags. In room 4 there appeared to be no consistent difference in the time of sprouting of the various lots. This may be due to the fact that the crate and bag stock was stored over the bins containing the bulk stock.

There appeared to be no direct correlation between the type of storage and the percentage of rot. When only Potter County stock is considered from the standpoint of rot, we find that in the three best lots there was a variation of only 0.22%. These three lots were represented by bin 14 which contained 4.66% of rot; a bag in Room 3 with 4.74% of rot, and a crate in room 1 with 4.88% of rot. There appears however, to be a slight tendency in favor of crate storage over bulk storage in the Potter County stock. In the case of the bag stock the results are more variable. It will be noticed that the crate storage in the old storage cellar showed considerable rot. Much of this rot was due to frosting during storage.

The best bin of Potter County stock in the Laboratory cellar was bin No. 6 which was the upper of the two three-foot bins. This bin showed approximately 7% of rot and very little shriveling of the tubers in the bottom foot, as was the case with many of the other bins, and was particularly true of the Potter stock.

Of the stocks from various sources and of different varieties, the amount of rot developed in storage indicates that the Irish Cobbler and Green Mountain stored best, with Sir Walter Raleigh next in order and Potter County Russets last. Of the remaining two, Bradford County Russets come fourth and Michigan Russets fifth.

In general, the occurrence of rots in the various lots and in different types of storage is irregular and erratic, and there naturally arises the thought that other factors than those under consideration may have played an important part in the commencement and development of this storage rot.

III

Field Tests of Stored Potatoes

W. A. McCUBBIN AND R. E. HARTMAN

Bureau of Plant Industry,
Pennsylvania Department of Agriculture

FIELD TESTS OF STORED POTATOES

W. A. McCUBBIN AND R. E. HARTMAN
Pennsylvania Bureau of Plant Industry

Samples of the potatoes held in storage under various conditions during the winter at The Marble Laboratory were selected and held for a field test, so that from their behavior in germination, growth differences or yield, further information might be obtained on the effects of the various methods of storage employed.

The test was conducted on the farm of R. W. Benjamin, of Towanda, (Bradford County) whose own seed potatoes, held in ordinary farm cellar storage, were utilized for the check rows. Between the opening up of the storage lots at The Marble Laboratory and the date of planting, the individual lots of Canton storage seed were kept in crates. During this period any sprouts developed in storage and rubbed off in handling were succeeded by short, thick, green sprouts. Mr. Benjamin's own seed taken from the cellar at the time of planting was unsprouted.

The field, which was fairly uniform as regards soil and contour, was planted May 20-21.

Preparation of the seed bed was excellent and fertilization was uniform. The field was lightly manured and a complete fertilizer (2-8-10) was applied at the rate of 800 pounds per acre.

The potatoes were planted on two succeeding days with no changing weather factor to vary the results. Planting was done with a two-man planter. The rows were approximately 300 feet long and the sets were placed 12 inches apart. The use of the planter varied the number of sets per row to some extent, but the exact number of sets used in each row was recorded. Seed was cut immediately before planting. Of

the various varieties stored at Canton only the Potter County stock of Russet Rurals was included in these tests.

Growing conditions were favorable from the date of planting, May 20th to June 1st.

Late blight appeared in several places thruout the field, and this must be taken into account in considering the variations in yield and their irregularity. It was found impossible at digging time to make any accurate estimate of the loss from late blight for each row, so the blighted tubers were merely discarded before weighing.

The table submitted (pages 139-142) gives the details of the plot, the observations made in summer, and the yield records; summaries made from these data are also given.

The condition of some of the various lots of seed used in these field tests when they came out of storage is illustrated in Plates VII-XV inclusive; and the remaining lots are similarly illustrated by samples shown in Section I, Plates II-V inclusive. Table V on p. 155 is given to provide a convenient reference to these last, which form parts of the general illustrations used in Sections I and II. All these illustrations are from photographs made by Mr. Marble's staff.

TABLE I

MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS

FIELD TESTS OF VARIOUS STORAGE LOTS

Row No.	Storage Conditions	Number Seed Pieces	JUNE 16, 1925			JUNE 29, 1925			Observations	Bushels Yield Per Row	Bushels Yield Per Acre
			% Germination	Average Height (Inches)	Number Weak Plants	% Germination	Average Height (Inches)	Number Weak Plants			
1.	Check. Bulk. (Benjamin)	309	68	3	2	81	10	24		4.35	203.92
2.	One air change per hour. Bulk. Bin No. 1. Top foot.	309	82	4	2	79	11	6	Superior to check.	6.25	292.9
3.	One air change per hour. Bulk. Bin No. 1. Center foot.	303	87	4	2	89	11	2		5.25	251.58
4.	One air change per hour. Bulk. Bin No. 1. Bottom foot.	293	78	4	3	81	11	7		5.5	272.52
5.	One air change per hour. Bag.	303	82	4	2	92	11	5		6.25	299.5
6.	One air change per hour. Crate.	303	79	5	4	93	12	3		6.75	323.46
7.	Check. Bulk. (Benjamin)	312	70	2–3	4	82	10	10	Very poor.	4.35	202.4
8.	Two air changes per hour. Bulk. Bin No. 2. Top foot.	304	84	4–5	3	89	12	5	Very uniform.	6.35	303.28
9.	Two air changes per hour. Bulk. Bin No. 2. Center foot.	320	87	4–5	2	89	12	0	Very uniform.	7.	317.59
10.	Two air changes per hour. Bulk. Bin No. 2. Bottom foot.	311	88	4–5	6	86	12	6	Very uniform.	6.	280.08
11.	Two air changes per hour. Bag.	321	80	4–5	4	84	12	3	Very uniform.	6.	271.38

TABLE 1—Continued

Row No.	Storage Conditions	Number Seed Pieces	JUNE 16, 1925			JUNE 29, 1925			Observations	Bushels Yield Per Row	Bushels Yield Per Acre
			% Germination	Average Height (Inches)	Number Weak Plants	% Germination	Average Height (Inches)	Number Weak Plants			
12.	Two air changes per hour. Crate.	319	84	4–5	6	92	12	7	Very uniform.	62.5	284.43
13.	Check. Bulk. (Benjamin)	318	75	2–3	14	82	10	4		5.	228.30
14.	Three air changes per hour. Bulk. Bin No. 3. Top foot.	321	86	4–5	4	90	12	9		6.	271.38
15.	Three air changes per hour. Bulk. Bin No. 3. Center foot.	314	82	4–5	3	87	12	3		5.60	259.5
16.	Three air changes per hour. Bulk. Bin No. 3. Bottom foot.	305	87	4	2	90	12	6		5.25	249.9
17.	Three air changes per hour. Bag.	313	82	4	19	89	12	6		6.35	294.51
18.	Three air changes per hour. Crate.	310	85	5	7	90	12	4		5.5	257.56
19.	Check. Bulk. (Benjamin)	315	75	3–4	14	86	10	6		5.	230.
20.	Four air changes per hour. Bulk. Bin No. 4. Top foot.	313	88	5	6	86	11	8		5.5	255.09
21.	Four air changes per hour. Bulk. Bin No. 4. Center foot.	320	87	5	3	90	11	2	Very good row.	6.5	294.90
22.	Four air changes per hour. Bulk. Bin No. 4. Bottom foot.	323	85	4–5	23	94	11	4		5.75	258.46
23.	Four air changes per hour. Bag.	316	84	4	15	84	11	3		5.75	264.15
24.	Four air changes per hour. Crate.	315	81	4	36	86	11	13		5.	230.
25.	Check. Bulk. (Benjamin)	318	81	3–4	16	86	11	11		5.	228.30

TABLE 1—Continued

Row No.	Storage Conditions	Number Seed Pieces	JUNE 16, 1925			JUNE 29, 1925			Observations	Bushels Yield Per Row	Bushels Yield Per Acre
			% Germination	Average Height (Inches)	Number Weak Plants	% Germination	Average Height (Inches)	Number Weak Plants			
26.	Four air changes per hour. Bulk. 6 ft. Bin No. 5. Top foot.	329	89	5	12	92	12	4		6.5	286.84
27.	Four air changes per hour. Bulk. Bin No. 5. Center foot.	316	94	5	10	96	12	3		6.25	287.12
28.	Four air changes per hour. Bulk. Bin No. 5. Bottom foot.	318	83	3–4	19	90	11	11	Many small plants.	5.1	232.86
29.	Four air changes per hour. Bulk. Bin No. 6. Top foot.	336	86	5	6	91	12	2	Very even rows.	6.4	277.54
30.	Four air changes per hour. Bulk. Bin No. 6. Center foot.	319	98	5	10	97	12	2	Very even rows.	5.25	238.92
31.	Four air changes per hour. Bulk. Bin No. 6. Bottom foot.	324	93	5	6	96	12	0	Very even rows.	6.75	302.46
32.	Check. Bulk. (Benjamin)	331	81	3–4	15	85	10	3		4.5	202.32
33.	Four air changes per hour. Bulk. Bin No. 7. Top foot.	343	88	4–5	14	92	11	4		7.25	306.89
34.	Four air changes per hour. Bulk. Bin No. 7. Center foot.	330	93	4–5	15	97	12	2		6.1	268.4
35.	Four air changes per hour. Bulk. Bin No. 7. Bottom foot.	336	89	4–5	26	95	12	3		7.	302.47
36.	Check. Bulk. (Benjamin)	339	77	3–4	12	88	10	8	Many small plants.	4.5	192.24
37.	Unventilated. Bulk. Bin No. 8. Top foot.	341	86	4–5	7	89	12	5		6.5	276.77
38.	Unventilated. Bulk. Bin No. 8. Center foot.	328	90	5	13	91	12	4	One of the best rows.	6.15	272.19
39.	Unventilated. Bulk. Bin No. 8. Bottom foot.	299	90	5	9	91	12	3	One of the best rows.	7.4	359.34

TABLE 1—Continued

Row No.	Storage Conditions	Number Seed Pieces	JUNE 16, 1925			JUNE 29, 1925			Observations	Bushels Yield Per Row	Bushels Yield Per Acre
			% Germination	Average Height (Inches)	Number Weak Plants	% Germination	Average Height (Inches)	Number Weak Plants			
40.	Unventilated. Bag.	333	94	4	8	92	11	3		6.5	283.4
41.	Unventilated. Crate.	339	93	4	7	92	12	3		7.1	303.38
42.	Check. Bulk. (Benjamin)	336	76	1–3	4	86	10	9	Germination 7 days late.	5.	216.05
43.	Bank cellar. Bulk. Bin No. 14. Top foot.	357	82	1–3	13	89	11	0	Germination 7 days late.	8.5	345.69
44.	Bank cellar. Bulk. Bin No. 14. Center foot.	328	85	1–3	31	90	11	2	Germination 7 days late.	6.9	305.49
45.	Bank cellar. Bulk. Bin No. 14. Bottom foot.	323	83	1–3	39	95	11	0	Germination 10 days late.	7.25	325.88
46.	Check. Bulk. (Benjamin)	343	82	4	20	86	11	10		5.7	241.28
47.	Unsprouted. Bulk.	340	92	4–5	25	96	12	2		7.75	303.92
48.	Excessive Sprouting.	357	91	4–5	42	95	11	5		6.75	274.5
49.	Shrivelled tubers.	357	63	4–5	23	93	12	7		7.5	305.02
50.	Small rot spots.	340	89	5	29	94	12	6	Very good row.	6.5	277.55
51.	Badly rotted tubers.	346	68	3–4	38	76	10	14	Plants spindly.	5.	209.85
52.	Wet throughout season.	361	83	4	36	90	11	13	High percentage of spindly plants.	6.1	245.34
53.	Check.									5.5	

TABLE II

1. Lowest germination of all the experimental storage potatoes, 88.20%
2. Highest germination of all the experimental storage potatoes, 91.80%
3. Average germination of all the experimental storage potatoes, 89.97%
4. Average germination of checks, 84.60%
5. Highest yield of all the experimental storage potatoes, 359.34 Bushels
6. Lowest yield of all the experimental storage potatoes, 230.00 "
7. Average yield of all the experimental storage potatoes, 281.60 "
8. Highest yield of checks, 241.68
9. Lowest yield of checks, 192.00 "
10. Average yield of checks, 216.08 "

TABLE III

Comparison of Germination and Yield from Potatoes Held in Various Types of Storage

Type of Storage	No. of Rows	Average Per Cent of Germination	Average Yield Per Acre in Bushels
Crates,	5	90.6	279.76
Bags,	5	88.2	282.58
Bulk—Top Foot,	9	88.5	281.26
Bulk—Centre Foot,	9	91.7	277.31
Bulk—Bottom Foot,	9	90.8	287.1
Check,	9	84.6	216.08

TABLE IV

Summary of Mean Yields in Bushels Per Row from Lots Subjected To Various Storage Treatments and from the Check Rows

Type of Storage	No. of Rows	Average Yield Per Row (bushels)	Coefficient of Variability (per cent)
Crates,	5	6.01 - .27	14.6
Bags,	5	6.17 - .03	1.5
Bulk—Top Foot,	9	6.59 - .12	8.0
Bulk—Middle Foot,	9	6.05 - .10	7.6
Bulk—Bottom Foot,	9	6.23 - .18	13.0
Check,	9*	4.80 - .08	7.4

* 10th check row not used because number of seed pieces in row is not given.

Dr. Freeman Weiss kindly offered to treat the results given in Table III by statistical methods in order to bring out the probable error involved in the averages presented.

He decided it was best to use the recorded number of bushels per row rather than the bushels per acre as given in the table, and recalculated the yield from each row to make these yields comparable on the basis of a uniform row of 320 seed pieces.

The results thus rechecked are given in Table IV. Concerning the bearing of these figures on the value of the experimental results, Dr. Weiss states that, "the variation between different rows of the same general treatment in most cases equals or exceeds the differences between treatments; i. e., there was no effect due to previous treatment of the stock that compensated or outweighed environmental differences."

DISCUSSION

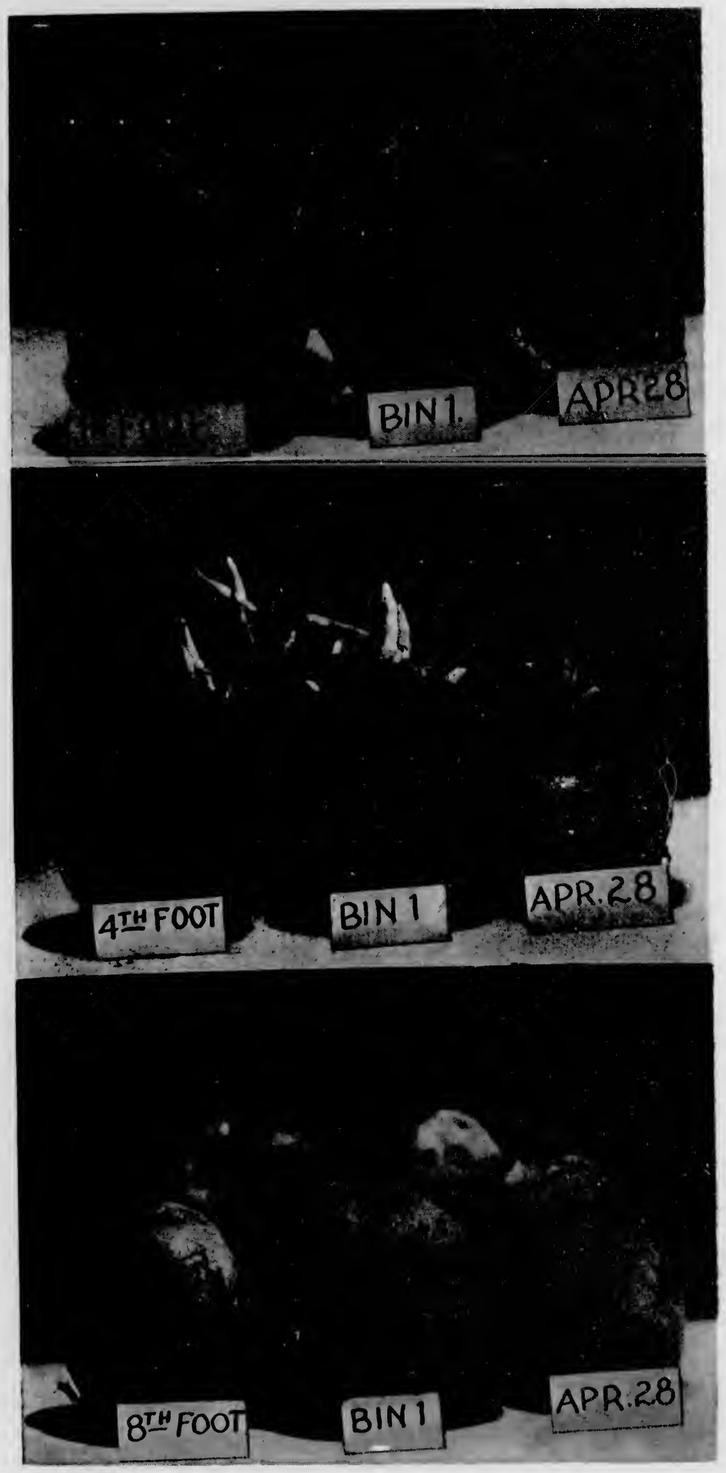
In these tests the effects of different conditions in storage might be expected to show themselves in an observable way in germination processes or in yield.

Germination percentages were recorded on June 16, at which time the general average was not high. The final germination counts given for June 29, are for this reason a truer measure of the actual situation in this respect. It will be noted that the departure from the average for all the experimental storage stocks (89.97%) is in every case not more than one would expect from experimental error (Table 1) except in the case of row 51 where badly rotted tubers were used and the cause of low germination is obvious. If one averages the germination percentages to cover bag, crate and bulk storage lots (Table III), again there is no difference which can be considered significant. In short the uniformity of germination thruout and the fairly high standard reached would suggest that the germination of the seed from the experimental storage had not been affected by any of the storage conditions to which it had been subjected. The uniform formation of healthy stubby green sprouts noted above bears out this conclusion.

Table III indicates a consistently lower average germination in the checks. While this is unimportant in any conclusions, it is worth noting; no cause can be assigned for this apparent difference beyond the guess that it might be the result of weather conditions or the outcome of using sprouted and dormant seed or a combination of both factors.

In the figures giving yield per acre the range of possible error is very wide due to the presence of blight, to say nothing of the other ordinary sources of variation, and since there was no replication to reduce these variations it is quite unsafe to make yield comparisons between the various rows. It is significant, however, that in spite of the unfavorable weather in June and the blight attack mentioned above the average yield of the experimental storage seed was 281.6 bushels per acre, and the lowest yield of any individual row was 230.0 bushels per acre; these yields are so normal for the stock, the variety and the locality that one finds it difficult to suspect that there has been any material impairment of its vitality resulting from the various storage conditions in which it was held. The figures on germination also bear out this view.

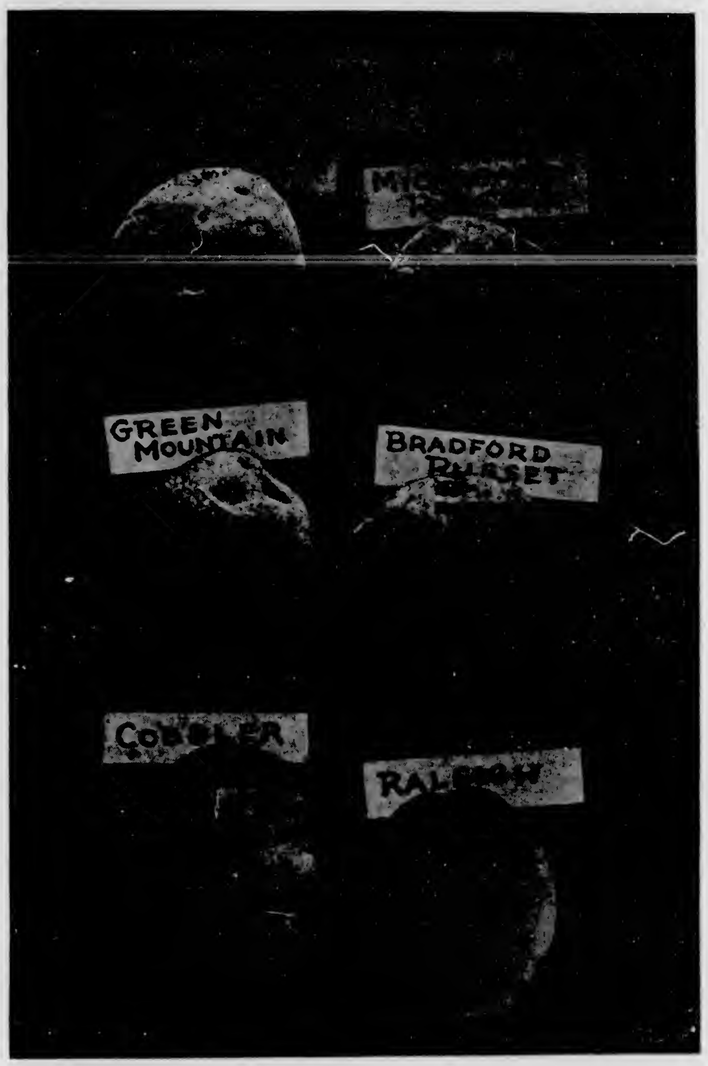
PLATE VII



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
2	6.25	292.9
3	5.25	251.58
4	5.5	272.52

PLATE VIII



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

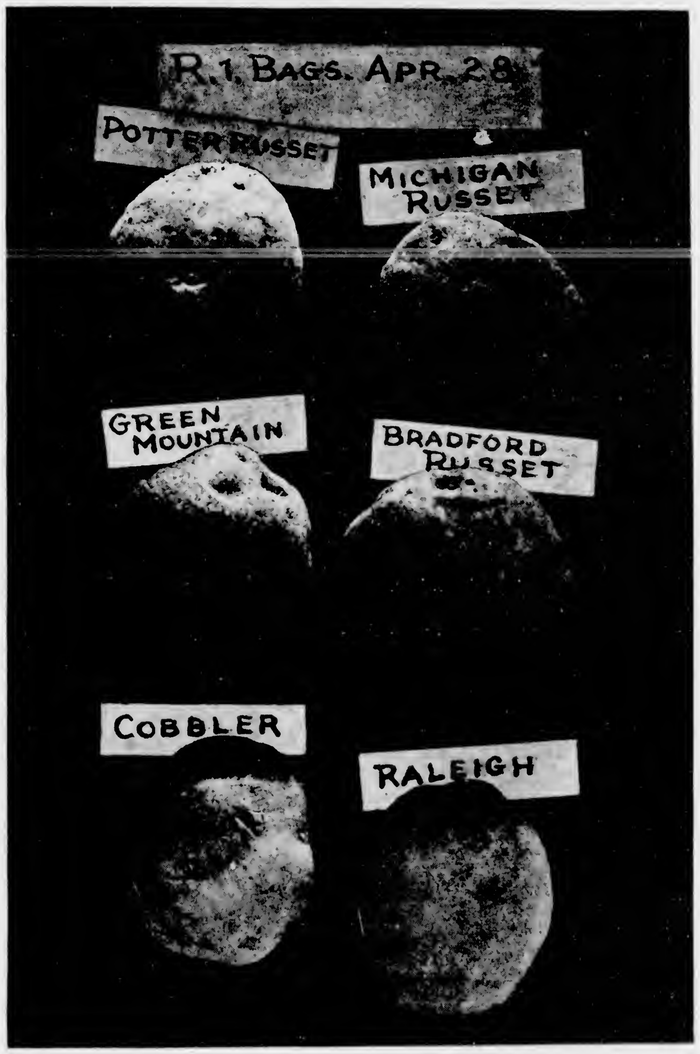
Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
5	6.25	299.5

PLATE VII

MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
2	6.25	292.9
3	5.25	251.58
4	5.5	272.52

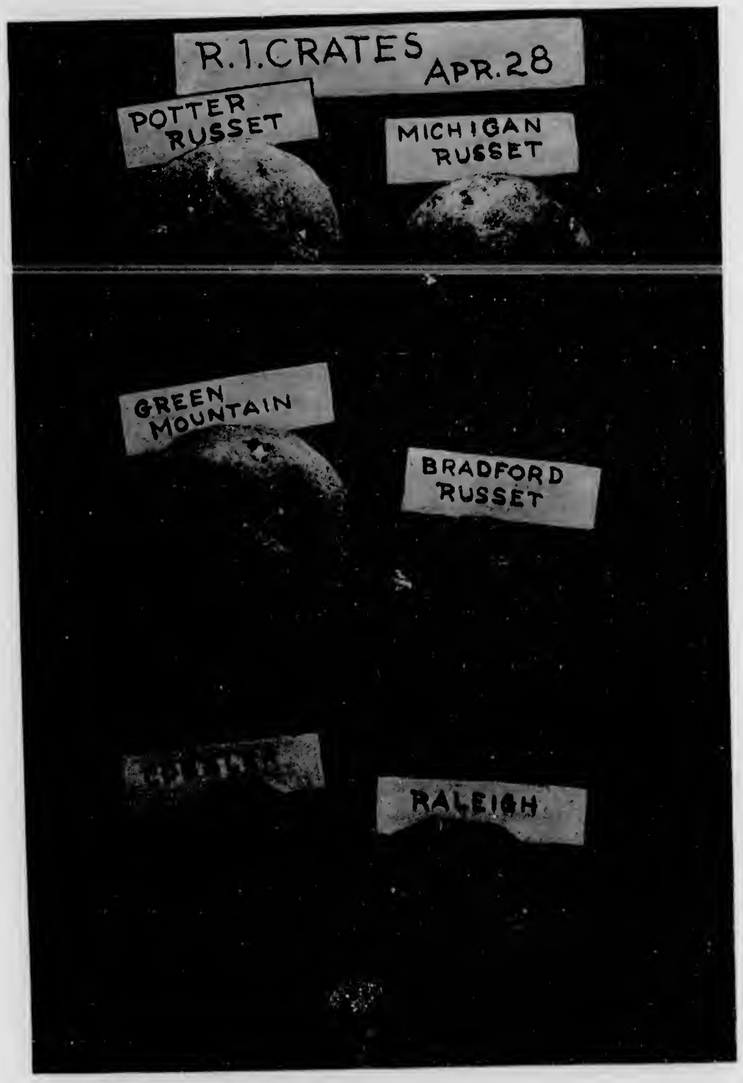
PLATE VIII



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
5	6.25	299.5

PLATE IX



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

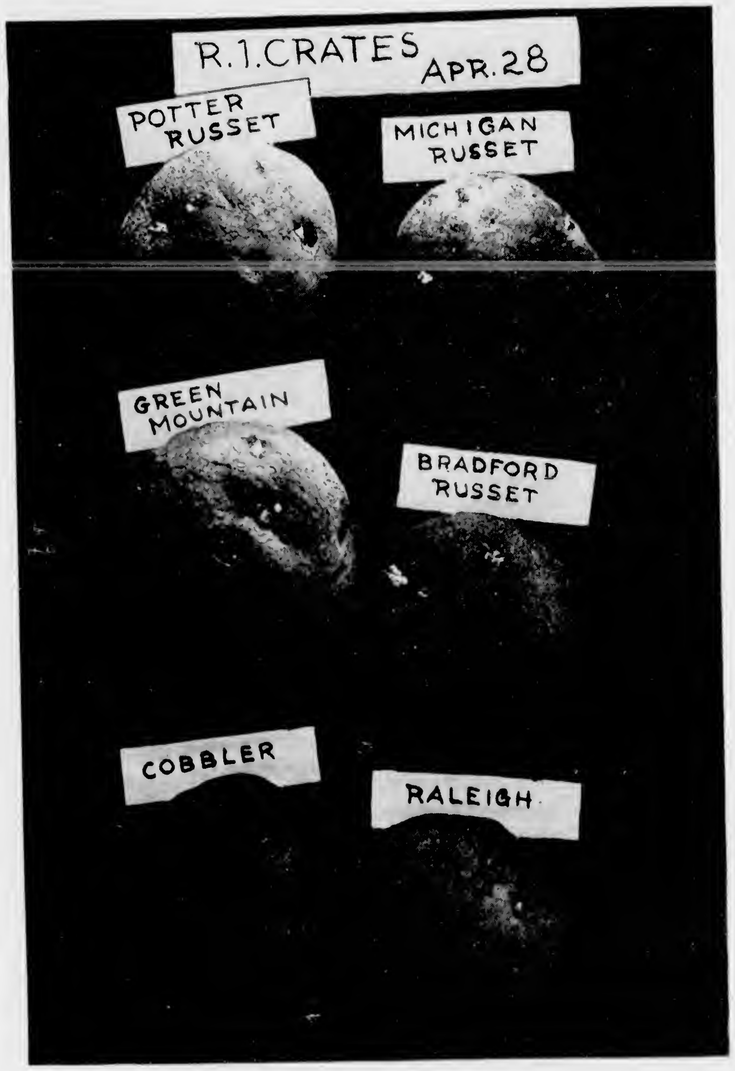
Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
6	6.75	323.46

PLATE X

MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
8	6.35	303.28
9	7.	317
10	6.	280.08

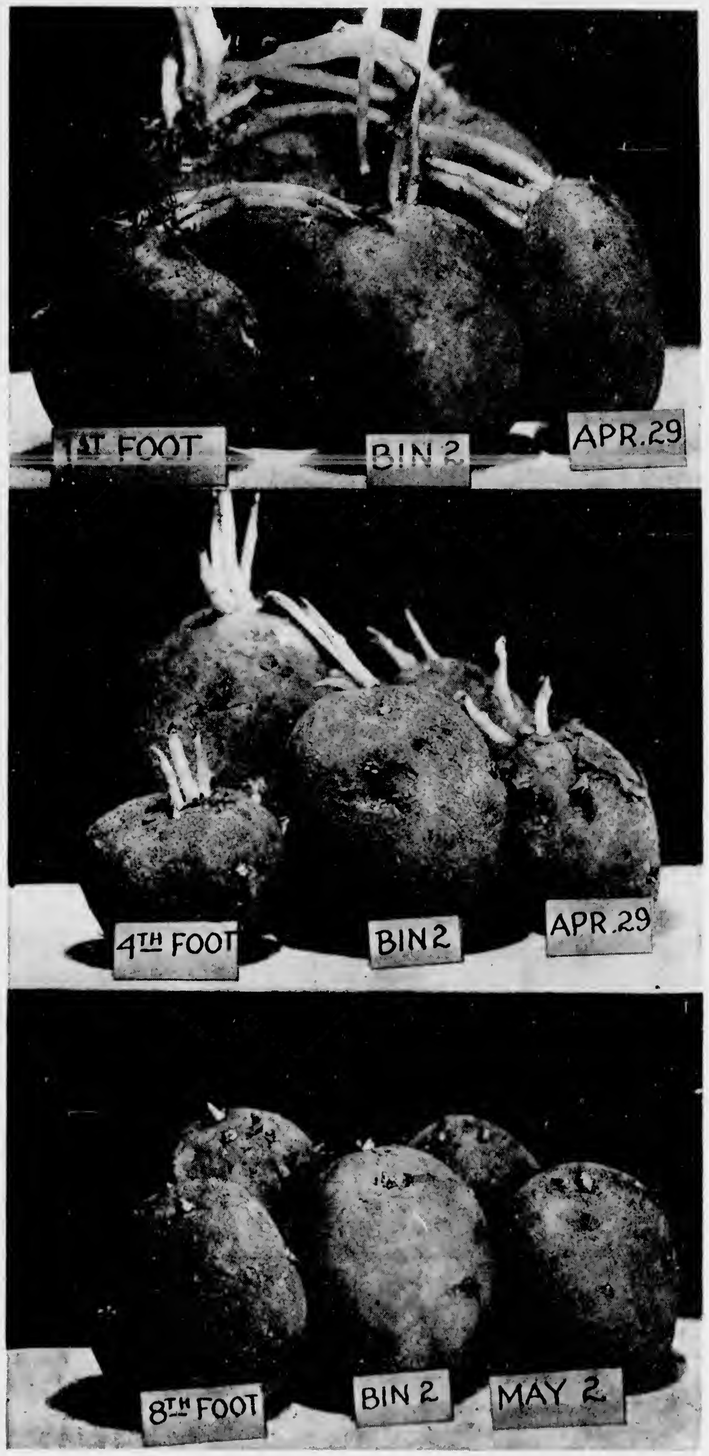
PLATE IX



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
6	6.75	323.46

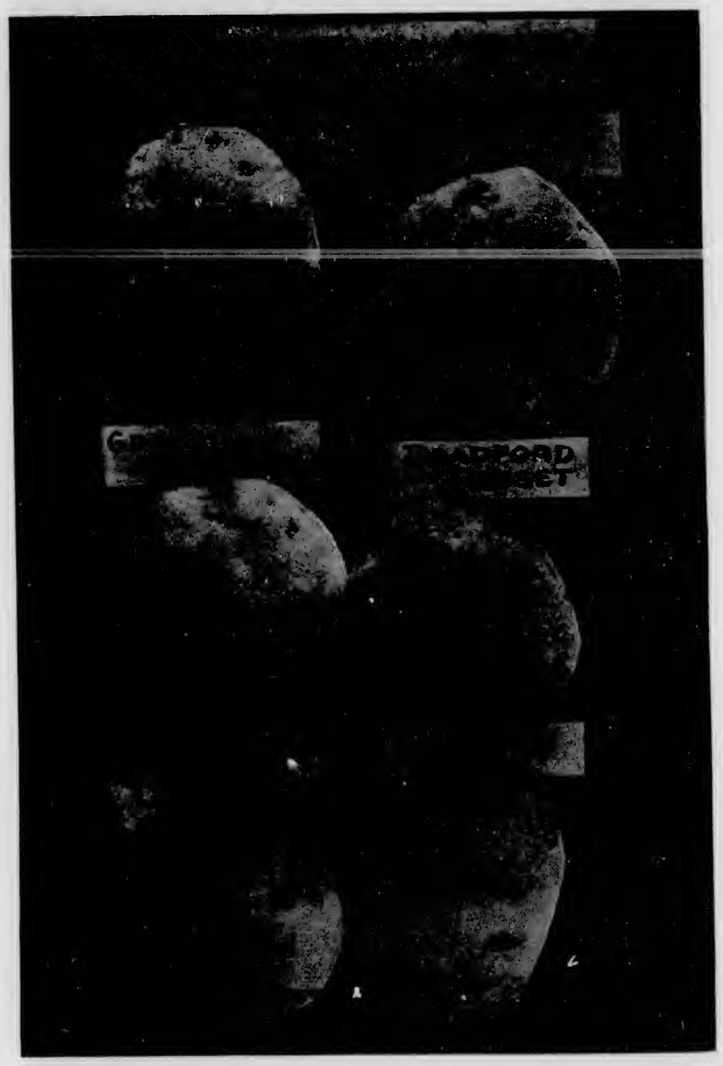
PLATE X



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
8	6.35	303.28
9	7.	317
10	6.	280.08

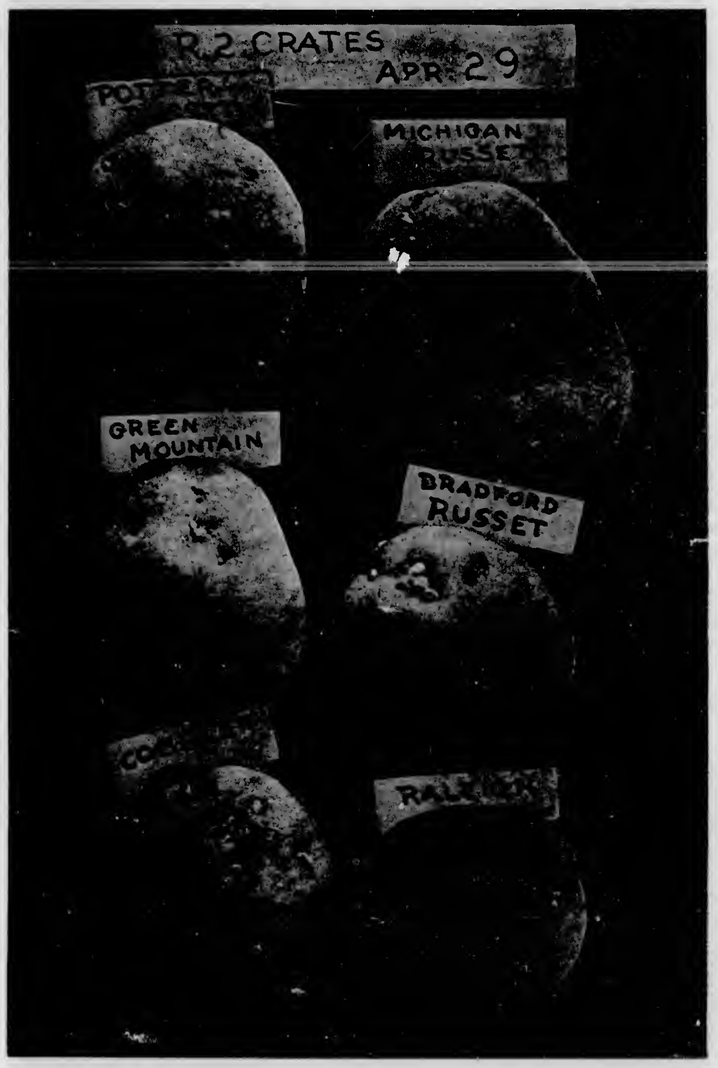
PLATE XI



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
11	6.	271.38

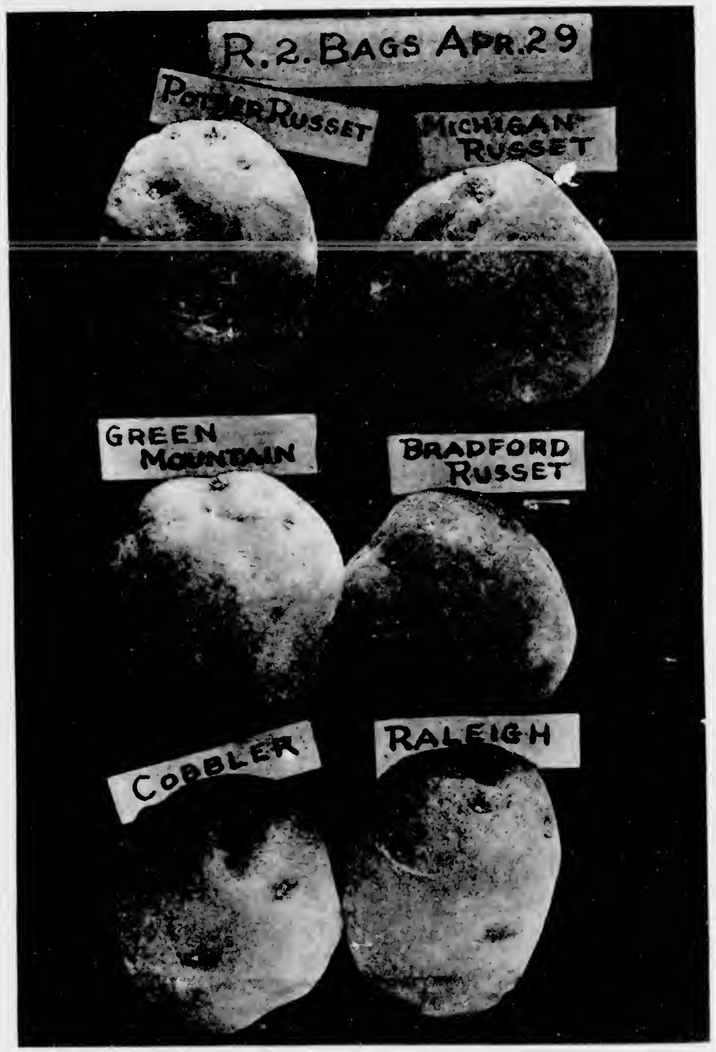
PLATE XII



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
12	6.25	284.43

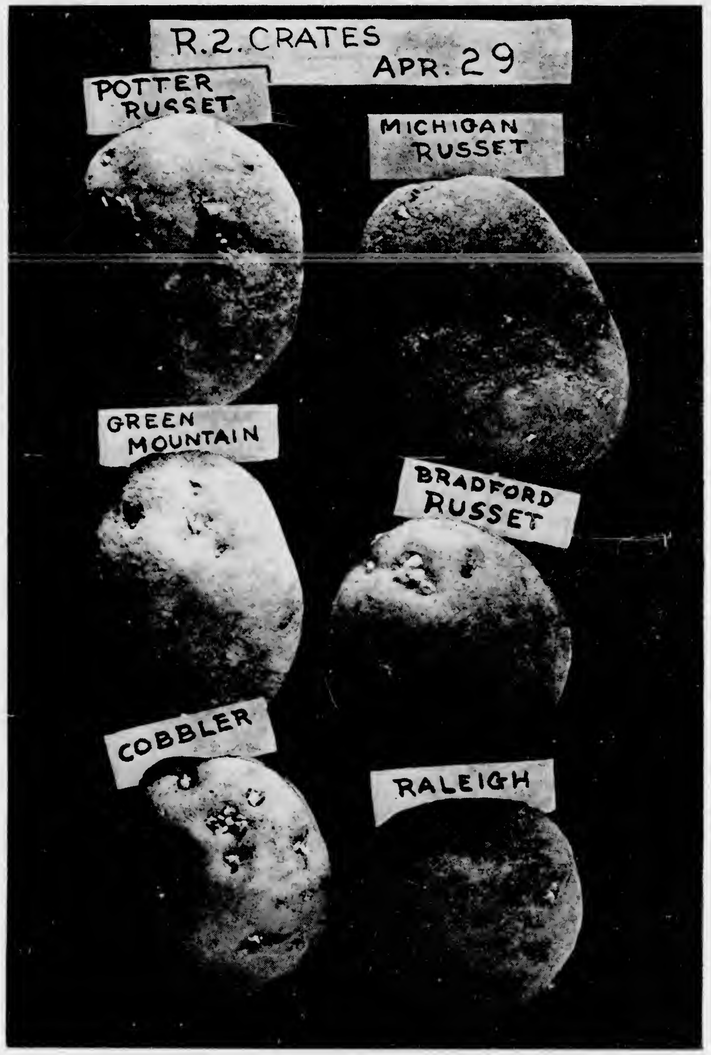
PLATE XI



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
11	6.	271.38

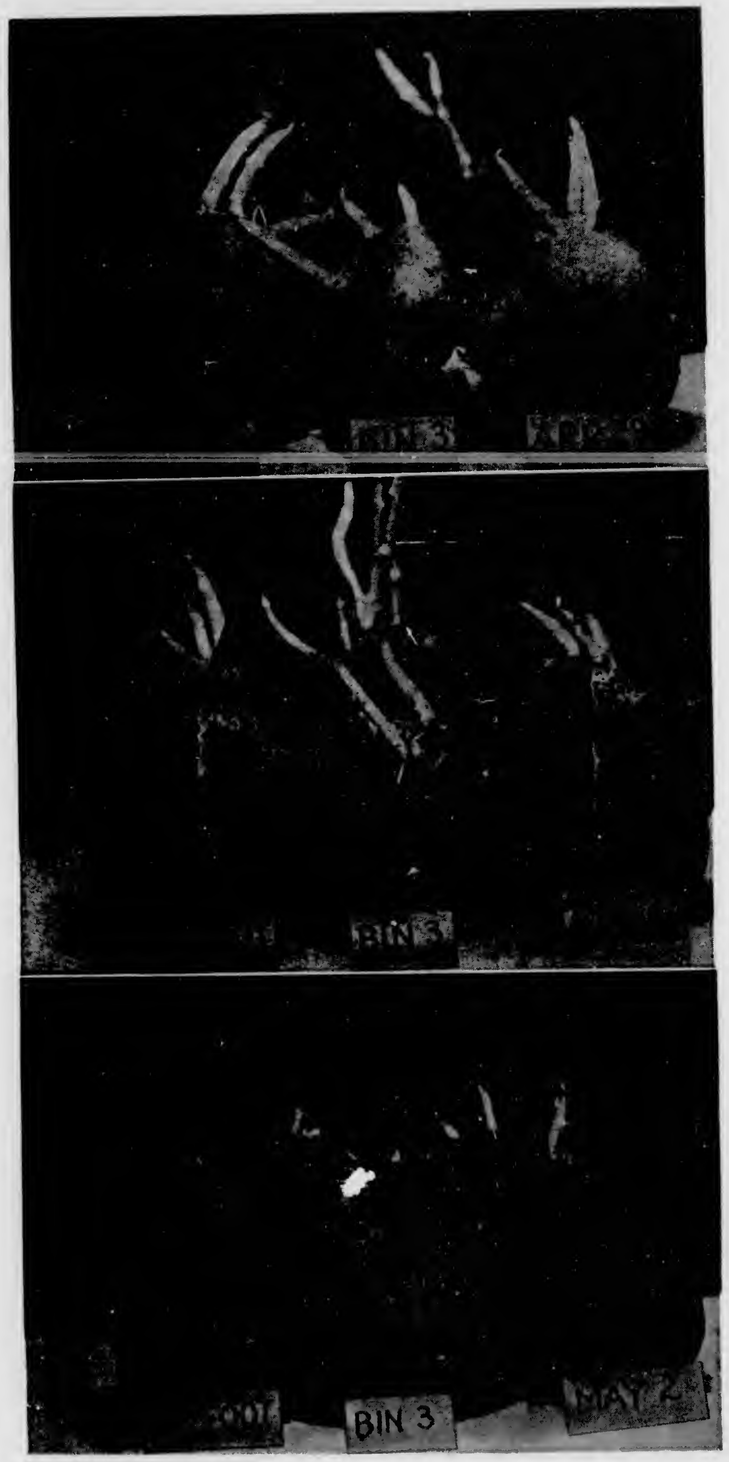
PLATE XII



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
12	6.25	284 43

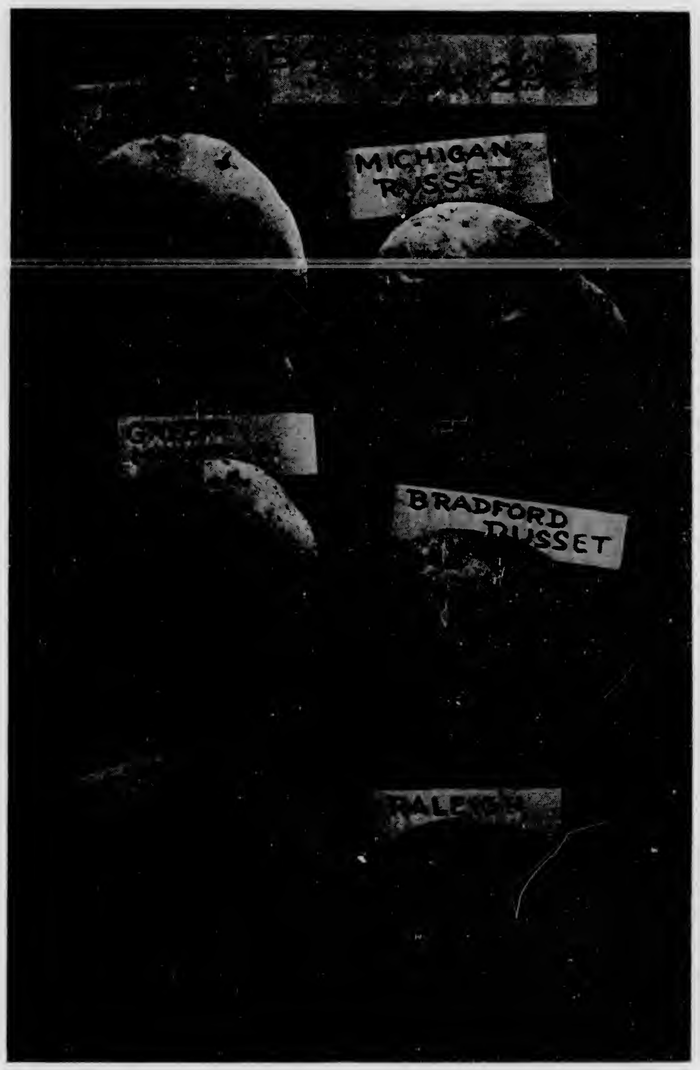
PLATE XIII



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
14	6.	271.38
15	5.6	259.5
16	5.25	249.9

PLATE XIV



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

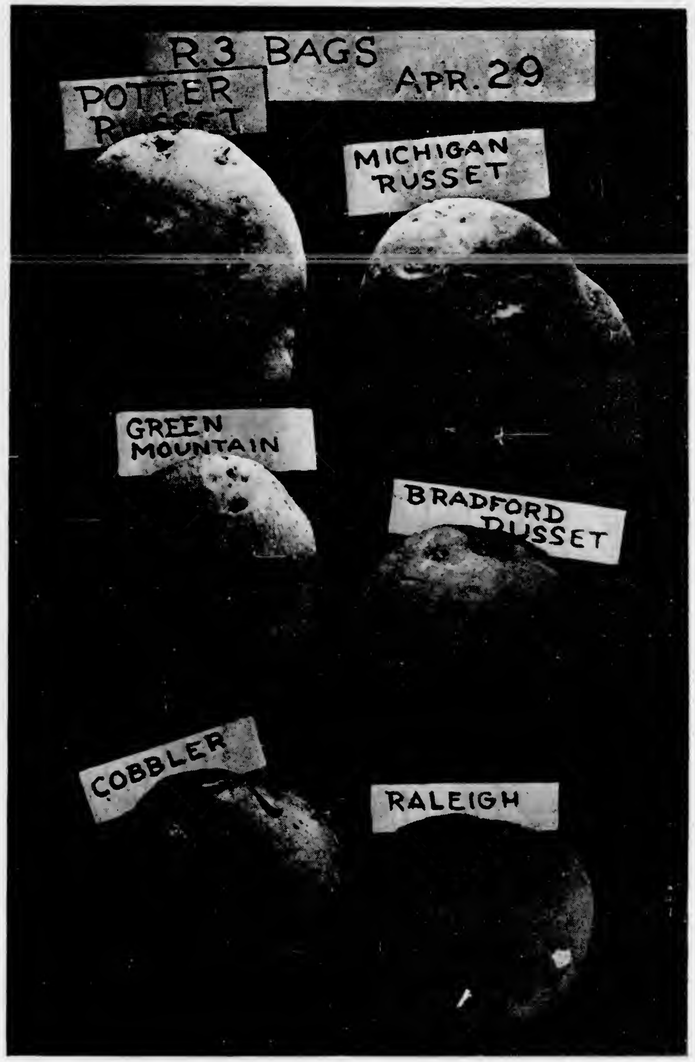
Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
17	6.35	294.51

PLATE XIII

MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
14	6.	271.38
15	5.6	259.5
16	5.25	243.9

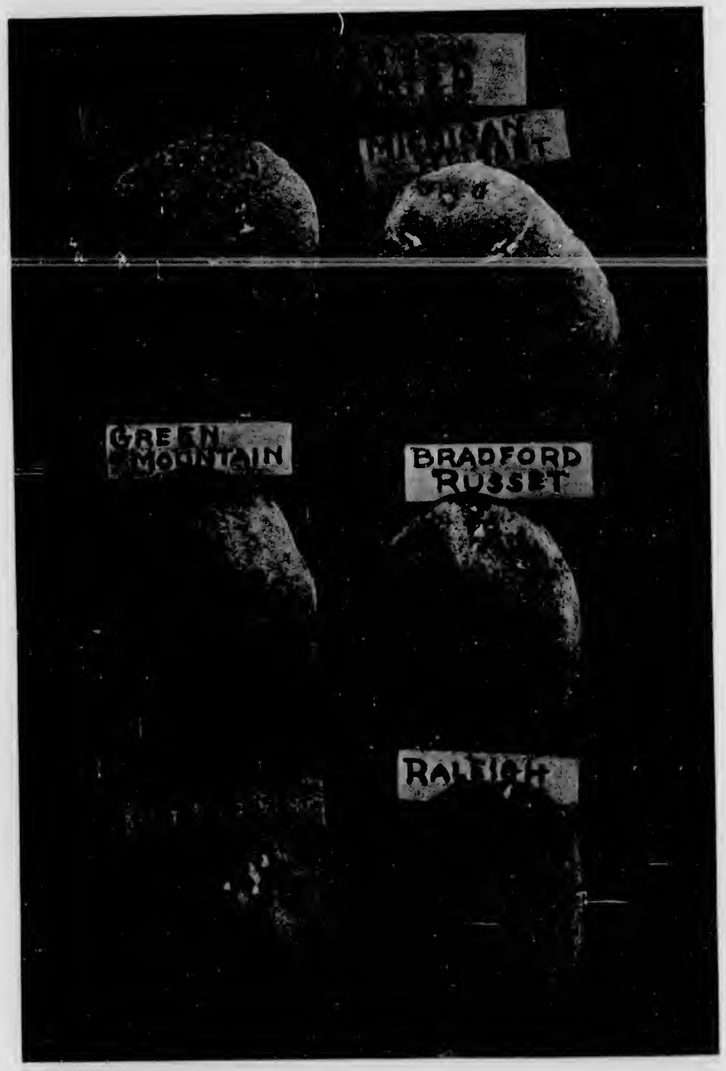
PLATE XIV



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
17	6.35	294.51

PLATE XV



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

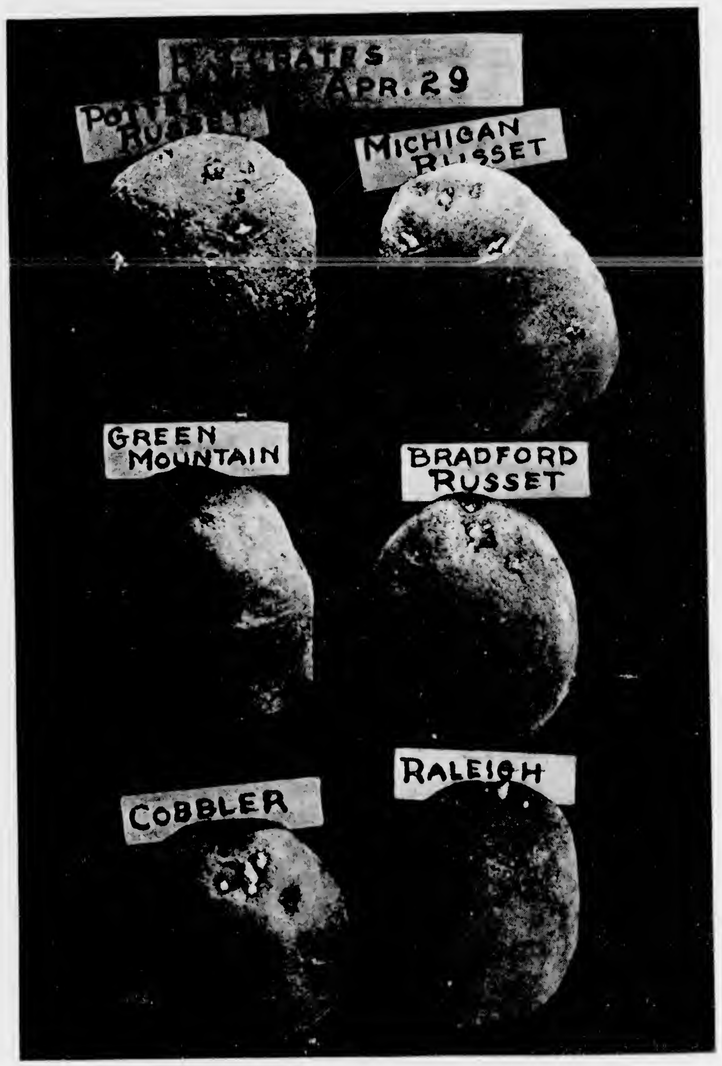
Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
18	5.5	257.56

TABLE V

Illustrations of storage lots used for field tests in addition to those shown in Plates VII-XV are to be found in Sections I and II of this report at points indicated in the following table. The row numbers refer to the row designations given in Table 1, pp. 139-142 inclusive.

Row No.	Found on	Bu. Yield Per Row	Estimated Bushel Yield Per Acre
20	Plate IV No. 1	5.5	255.09
21	" " 2	6.5	294.90
22	" " 3	5.75	258.46
23	" " 19	5.75	264.
24	" " 18	5.	230.
26	" " 7	6.5	286.84
27	" " 9	6.25	287.12
28	" " 11	5.1	232.86
29	" " 12	6.4	277.54
30	" " 13	5.25	238.92
31	" " 14	6.75	302.46
33	" " 15	7.25	306.89
34	" " 16	6.1	268.4
35	" " 17	7.	302.47
37	Plate III " 7	6.5	276.77
38	" " 10	6.15	272.19
39	" " 12	7.4	359.34
40	Plate V " 8	6.5	283.4
41	" " 7	7.1	203.38
43	Plate II " 1	8.5	345.69
44	" " 4	6.9	305.49
45	" " 6	7.25	325.88
48	Plate IV " 2	6.75	274.5
49	" " 15	7.5	305.02

PLATE XV



MARBLE LABORATORY POTATO STORAGE INVESTIGATIONS.

Row No.	Bushel Yield Per Row	Estimated Bushel Yield Per Acre
18	5.5	257.56

TABLE V

Illustrations of storage lots used for field tests in addition to those shown in Plates VII-XV are to be found in Sections I and II of this report at points indicated in the following table. The row numbers refer to the row designations given in Table I, pp. 139-142 inclusive.

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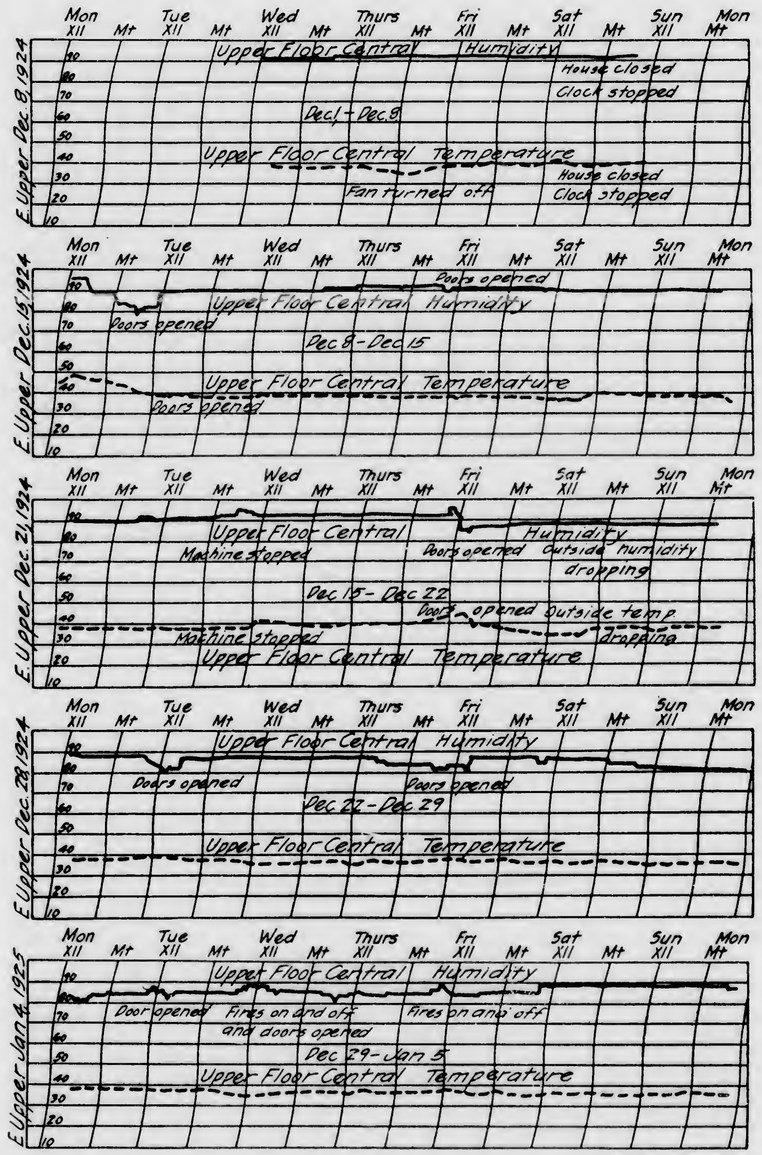
IV

Observation on Potato Storage Conditions at Coudersport Warehouse, 1924-1925

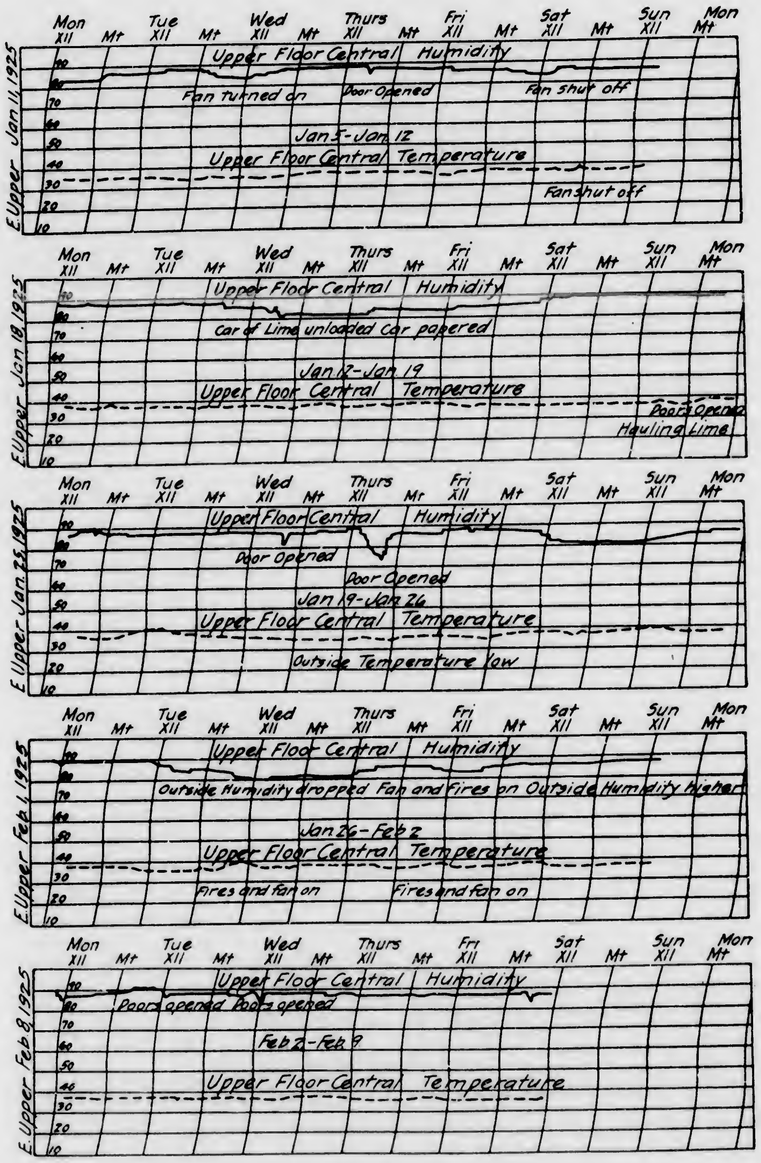
W. A. McCUBBIN

Plant Pathologist, Bureau of Plant Industry,
Pennsylvania Department of Agriculture



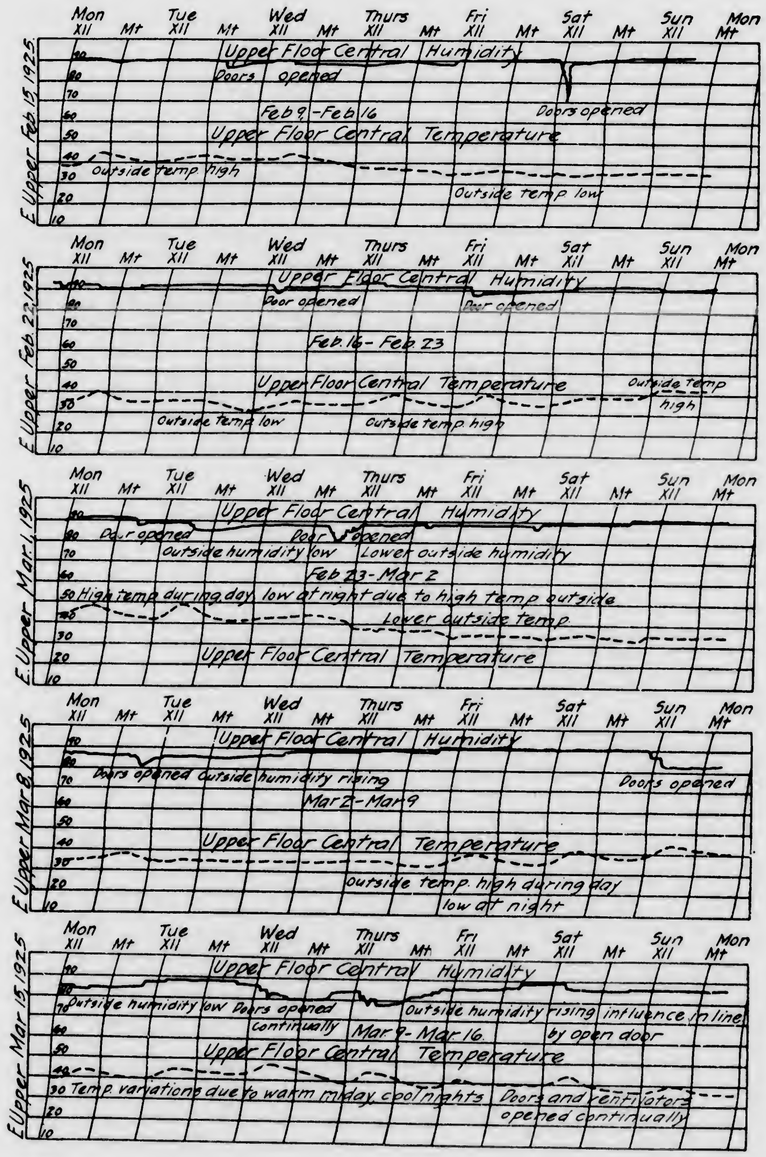
HYGROTHERMOGRAPH RECORDS—SERIES I. (a)

Records taken by a Friez Hygrothermograph on the central and eastern part of the upper floor of the Coudersport warehouse from Dec. 1, 1924 to Jan. 5, 1925.



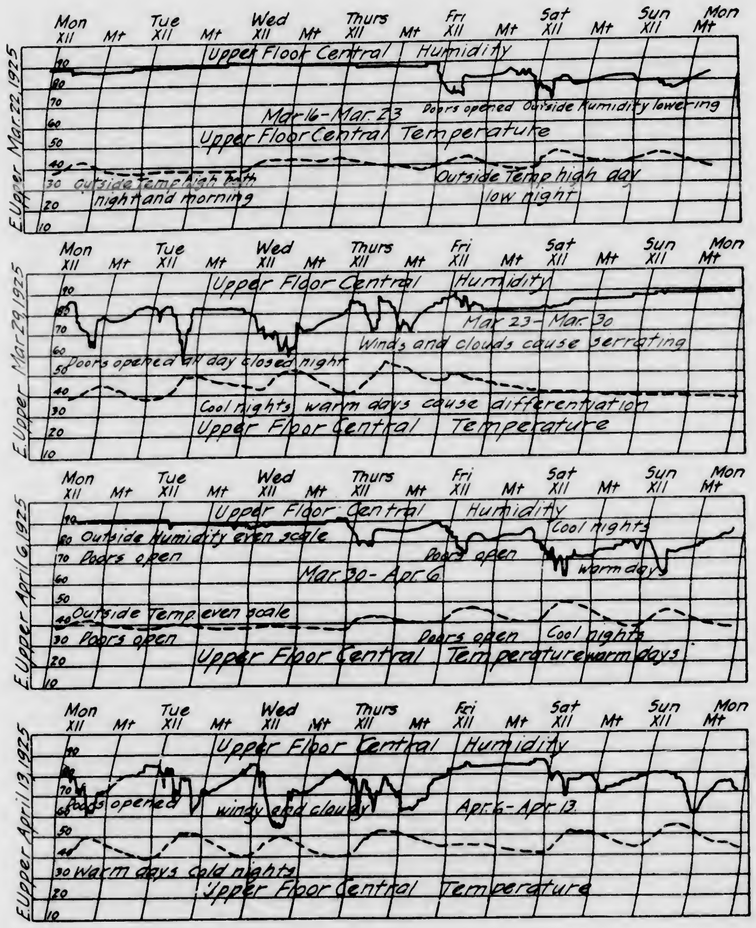
HYGROTHERMOGRAPH RECORDS—SERIES I. (b)

Records taken by a Friez Hygrothermograph on the central and eastern part of the upper floor of the Coudersport warehouse from Jan. 5, 1925 to Feb. 9, 1925.



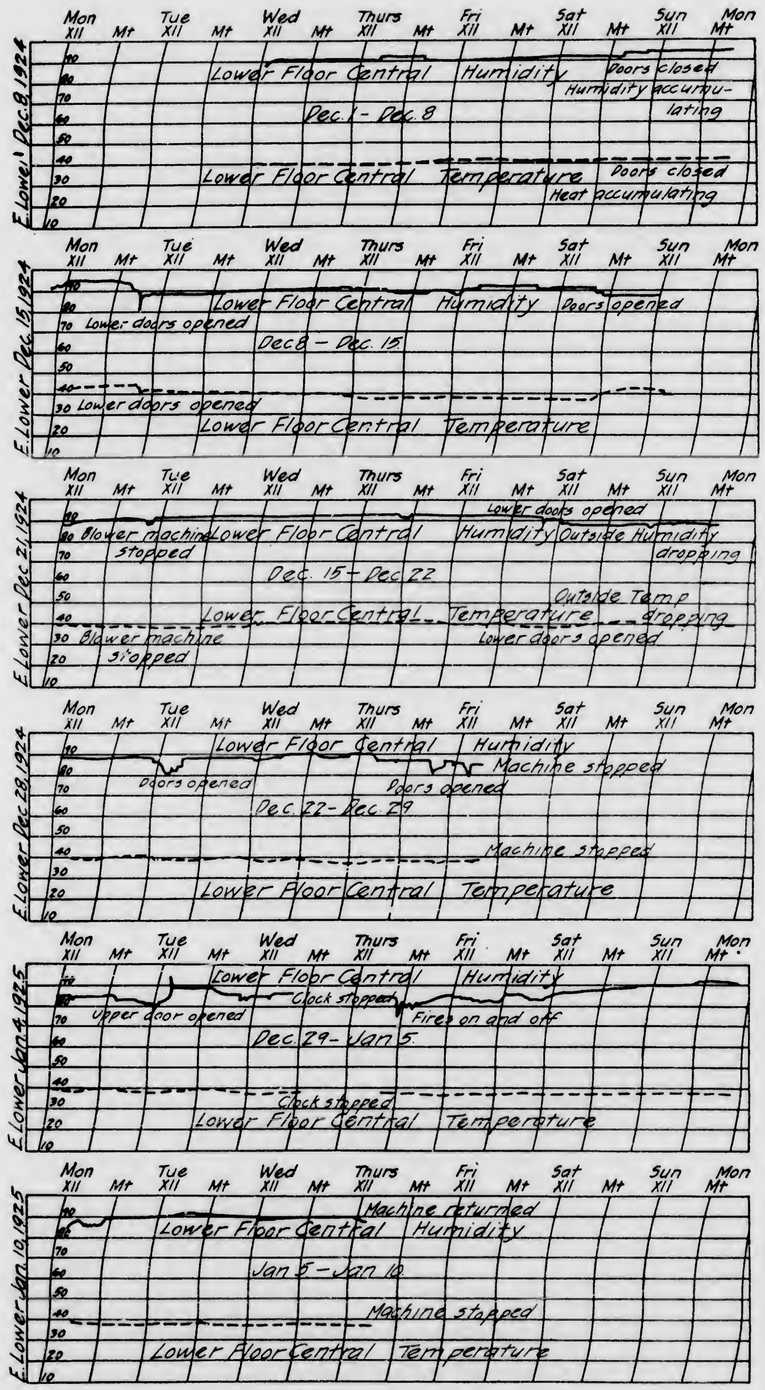
HYGROTHERMOGRAPM RECORDS—SERIES I. (c)

Records taken by a Friez Hygrothermograph on the central and eastern part of the upper floor of the Coudersport warehouse from Feb. 9, 1925 to March 16, 1925.



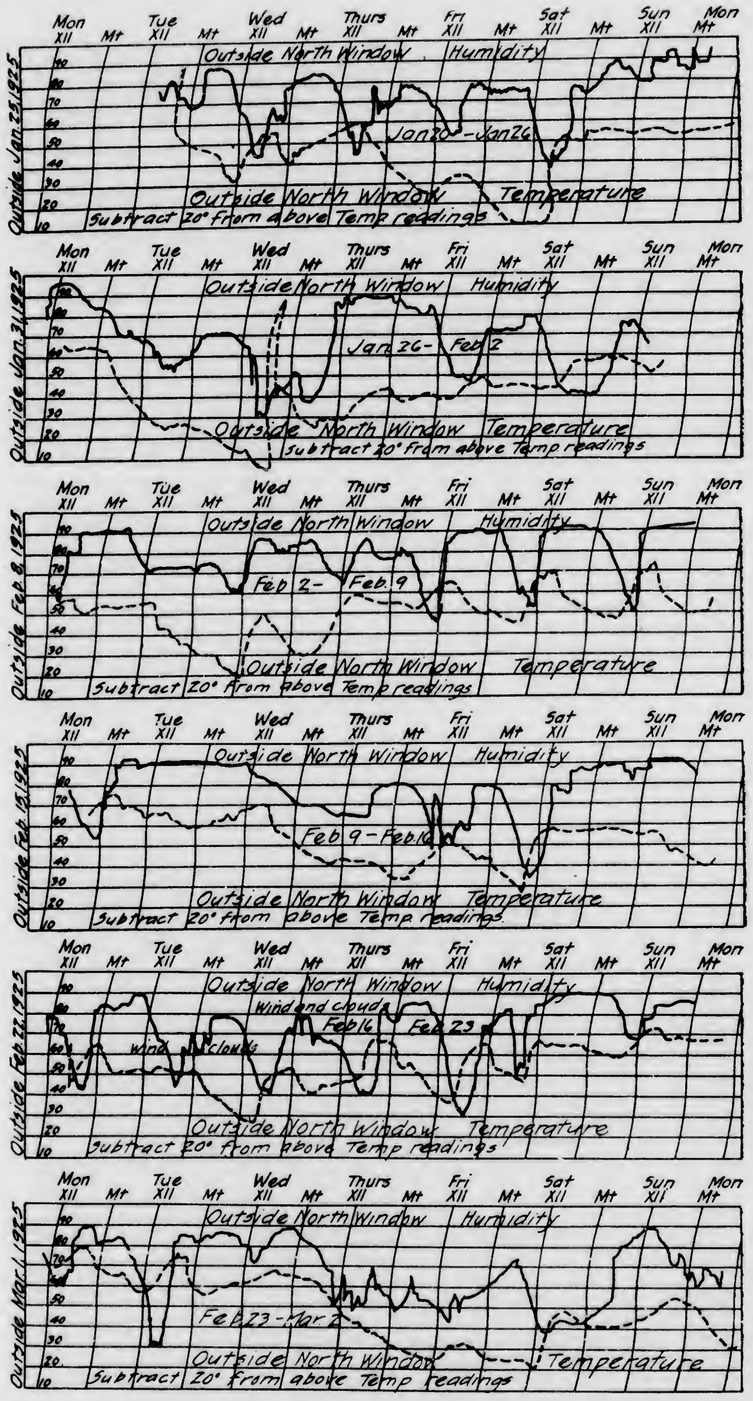
HYGROTHERMOGRAPH RECORDS—SERIES I. (d)

Records taken by a Friez Hygrothermograph on the central and eastern part of the upper floor of the Coudersport warehouse from March 16, 1925 to April 13, 1925.



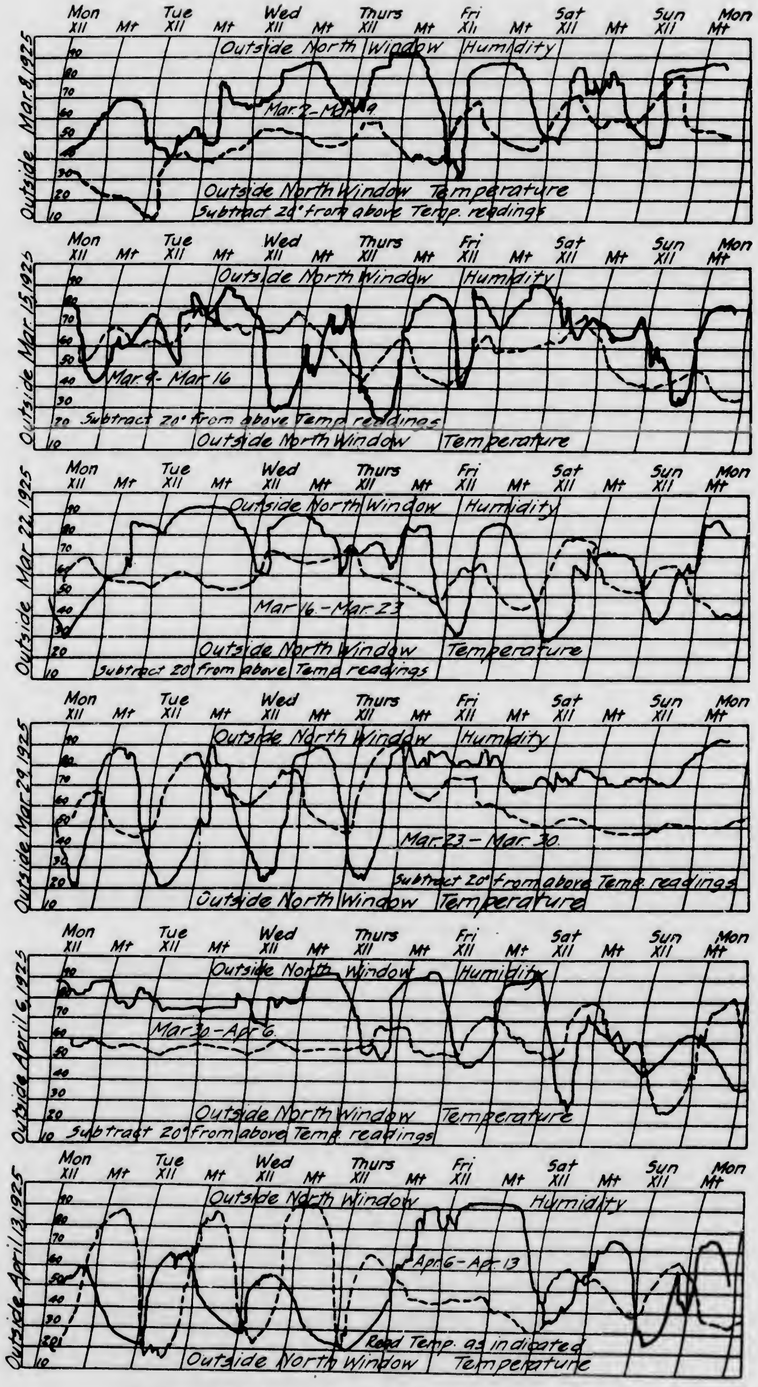
HYGROTHERMOGRAPH RECORDS—SERIES II.

Temperature and humidity as recorded by a Friez Hygrothermograph on the eastern central part of the lower floor of the Coudersport warehouse, Dec. 3, 1924 to Jan. 10, 1925.



HYGROTHERMOGRAPH RECORDS—SERIES III. (a)

Records of temperature and humidity made by a Friez Hygrothermograph in the open air outside a north window at the Coudersport warehouse, Jan. 19, 1925 to March 2, 1925.



HYGROTHERMOGRAPH RECORDS—SERIES III. (b)

Records of temperature and humidity made by a Friez Hygrothermograph in the open air outside a north window at the Coudersport warehouse, March 2, 1925 to April 13, 1925.

OBSERVATIONS ON POTATO STORAGE CONDITIONS AT THE COUDERSPORT WAREHOUSE, 1924-25

Following the recommendations of the Committee, the Department of Agriculture arranged for the presence of an observer in the Coudersport warehouse during the storage season to take records of the temperature, moisture and other conditions which might affect the keeping qualities of the potatoes stored there.

Owing to difficulty in finding a capable man at short notice no one could be assigned to this work until November 1st, when Mr. Floyd F. Smith was placed there. Later he was replaced by R. G. Test who continued the observations till the close of storage, April 15.

The following report is a digest of the results obtained by them.

1. Temperature Records.

A—Room temperatures:

Constant records of room temperature were obtained by Friez Hygrothermographs, one of which was placed as centrally as possible at the side of the aisle and about 5′ from the floor in the upper floor, and another similarly located on the lower floor. In addition a checked Fahrenheit thermometer was placed in the northwest corner of the upper floor and a maximum-minimum thermometer in the southwest corner of this floor; a similar series was placed in the lower floor in the southwest and southeast corners respectively.

The accuracy of all thermometers used was checked in the beginning against a standard laboratory thermometer and they were found to agree closely.

Readings were taken thrice daily (except Sunday) at approximately 9 A. M., 1 P. M., and 5 P. M., at which periods the temperature line on the hygrothermograph was checked against a thermometer and adjustment made if necessary. At no period did either instrument show more than 1 degree variance from the mercury thermometer.

The hygrothermograph records (Series I and II) indicate that the temperature was maintained in very uniform fashion, except the last week in February, until March 9, and that thereafter the upward fluctuations were not great and were of short duration until about the end of March. After this time the rising temperature outside and

much opening of doors for grading and shipping caused very considerable rises in room temperatures, especially in the upper floor.

The facts that sprouting was delayed satisfactorily on the one hand and on the other hand that the stored potatoes were not injured by any low temperatures are good evidence that the storage temperature in general was satisfactory as far as normal tubers were concerned. Apparently the management was able to, and did, keep the room temperature during the greater part of the storage period within a reasonably close range of variation from the 38 degrees which was accepted at the beginning as the desirable point.

These further points are worthy of note:

A—Aside from points close to walls or doors where outside temperature exerts local influence there has not been noted any appreciable difference in the general room temperature on the same level.

The upper floor has an average temperature of about 2-4 degrees higher than the lower, and is far more subject to fluctuations caused by outside temperatures and by the fact that operating doors and windows are all on the upper level.

B—Outside temperature records:

Series 3 shows hygrothermograph records immediately outside the building covering the period from January 20th to April 13th. This record provides a comparison with the inside upper floor charts in table.

C—Bin, crate and bag temperatures:

An attempt was made to get temperature records in the interior of bin, bags and crates. For the three bins under observation one of the tubes used in the Canton experiments was buried in each bin vertically so that the readings of temperature were 1, 2, 3 and 4 feet below the surface and 3 feet in from the front of the bin in its center. Readings were made daily (8 to 9 A. M.) thruout the whole storage period. Analysis of the records for these bins indicates that while slight differences are to be noted in readings from day to day or in different locations, there has existed no constant temperature variation which would indicate heat production at any level. All changes noted could be correlated with change of room temperature, the use of

fans, opening of doors, etc. The only possible exception was a slight apparent increase in the 2 foot level in all bins during several days in January; this was not in evidence in the February figures. All bins were on the upper floor.

On the lower floor crate temperatures were observed. Temperatures were taken in two places, in the center of a pile of crates in the middle of the room, and in the center of a pile of crates 3 feet from the east wall. In the last case three readings were made, at 3 and 5 foot depths from center top and 1 foot deep, three feet from the floor on one side. All readings daily (8 to 9 A. M.)

There is no constant temperature difference in these locations and while the average of the temperatures for January and February is nearly a degree lower in the side than in the interior in this second pile of crates this is easily accounted for by nearness of the side to the outside wall. Similarly there is a higher average temperature in the crate pile in the center of the room than in the second pile near the wall which is similarly explainable. Moreover a comparison of the crate temperatures with room temperatures nearby shows that sometimes one is higher and sometimes the other, depending on whether the general temperature is rising or falling and agreeing with an expected lag in the crates.

In a pile of sacks 13 sacks long, 7 wide and 6 deep on the lower floor was placed a temperature tube vertically between the sacks three feet from the end and three feet from one side. Another was inserted horizontally in a bottom outside bag of the lowest tier of this pile, 25 feet distant from the first. A third was inserted in the same location in a second pile. Still another was inserted to get temperatures at 3 and 5 foot levels between the second and third tiers in the center of the top of a third pile. A fourth tube was placed in this third pile horizontally between the sacks two tiers from the top.

The only case in which any constant temperature differences in bags was observed was in the case of some frosted stock running about 75% frost. During December and January the temperature rose 2 to 4 degrees in this bag above the general room average, but gradually fell back to normal in February. All other variations in the temperature in sacks are readily attributable to local conditions.

2. Humidity Records

A—Air moisture:

Humidities were taken in the storage room thruout the storage period from December 3 on the upper floor using a Friez hygrothermograph; and on the lower floor from the same date to January 10. A further hygrothermograph record of temperature and humidity was secured outside the building from January 19 to April 13.

The instruments were placed in the sides of the aisles in each floor. They were checked thruout three times daily by comparison with a sling psychrometer and adjusted if necessary. Little adjustment was needed at any time.

The accompanying charts 1, 2 and 3 give the records obtained.

In addition to the hygrothermograph records, readings were made in four other parts of the building, two above and two below each day as well as outside when weather permitted and until the extra hygrothermograph was placed outside.

While in general the humidity range on the whole floor is fairly close for any set of observations, differences in humidity of as much as 10% between different parts of the room have been noted. There is also a fairly wide variance between the two floors particularly in the spring months when higher temperatures on the upper floor were accompanied by a lowering of relative humidity.

During December, January and February the humidities on the upper floor ran close to or over 90%, usually above 85, and only on two occasions falling below 80; on January 21 for about four hours and on February 15 for two hours. This high humidity also continued until March 20 with one 10 hour drop below 80 on March 13. After March 20 the humidity curve went much lower and became very irregular due to higher outside temperatures and frequent opening of doors.

In the lower floor the instrument used was subject to several interruptions and was taken out of use January 10. It indicated, however, during the period of use, a slightly higher humidity than on the upper floor. The psychrometric readings were continued on the lower floor till March 16.

B—Factors affecting humidity:

It is observed that opening doors when the outside air is relatively dry causes the recording needle to drop markedly and quickly.

But when the doors are again closed the needle moves back very quickly to its original level.

Similarly, when the ventilating blower started the humidity lowers, especially when the air was heated. This lowering ran to nearly ten points when fan was run all night but the humidity rose rapidly when the fan stopped so that in two hours the humidity reached within a couple of degrees of the original point.

The three ventilators in the roof showed differences in air currents as shown by hanging paper strips. On clear days with wind there was a distinct movement upwards in all ventilators but especially in the central one. Dull days even with wind caused but little air movement in these shafts. In no case was the ventilator air movement observed to reduce the humidity curve when this movement was the only factor present.

Of all factors observed which were likely to affect humidity the opening of doors gave most marked results with the blower next in value.

C—Humidity at air vents:

Tests were made of the air humidity being forced thru the underground conduit system (a) just as it left the fan, and (b) at the point of delivery at the bottom of the bins. The sling psychrometer was used for this purpose. The fan was running full with heater about one-third capacity outside temperature 11 degrees and outside humidity 53%.

Tests from the vent at the blower and at two of the outlets gave temperature of 40 degrees and humidity 61% in all.

In a similar test where the outside temperature was 17 and humidity 50. the room temperature 34 and humidity 90, test of air from the vents gave a temperature of 30 and humidity of 80. *

D—Effect of Electric Fans on Bin Moisture:

Four 14″ electric fans were employed in various ways to overcome the deposition of moisture on the surface layers of potatoes in bins. From 4 to 24 hours' use of these fans was sufficient to

*This record is probably erroneous, since raising the temperature would undoubtedly decrease the relative humidity.—W. A. Mc.

dry off visible moisture from the upper layers of tubers as deep as surface moisture was present. The length of time the fan must be run was entirely dependent on the temperature and humidity of the air in the room; also the field of action was confined to areas where the strong air currents swept over the pile. This was checked by streamers of papers.

When the fan was discontinued moisture reappeared on the tubers, the length of time for reappearance being closely connected with air moisture and temperature conditions.

Opening doors on suitable days is very much more efficient in removing surface moisture than these fans; half an hour to two hours would accomplish approximately as much drying as 4 to 24 hours with fans.

3. Study of Air Currents

Some idea of the direction and intensity of air currents in the building was obtained by hanging thin paper strips in various places and observing their movement under different conditions. Under ordinary conditions there was scarcely any movement. The blower caused a general air movement but did not bring about a strong draft in the roof ventilators. The greatest air movement occurred on opening the doors and this also caused the strongest current up the ventilators in the roof. Heaters produced considerable air movement largely of an upward type which went in the general direction of the central ventilator. Heaters alone, however, did not appear to cause much movement out thru the ventilators. The effect of the electric fans was largely local as already noted. Strong winds (South or Northwest) rendered the roof ventilators active, especially when the air outside was somewhat dry.

4. Condensation and Dripping on Roof

The use of a ceiling above the upper floor did not prevent condensation of air moisture on the cold roof and consequent dripping. However, the false floor did intercept much of the drip and allowed it to evaporate again so that comparatively little of it found its way into the potatoes below. The wetting of potatoes from drip water occurred only in a few places and only at intervals.

It is apparent that the present arrangement of ceiling, attic and roof do not provide insulation complete enough to prevent dripping.

Two suggestions are made: That the attic flooring be made airtight in some way; and that provision be made for ventilating the attic in some way.

5. Healing of Cut Potatoes With Rot

The following tests are of value only as an indication of the effect of storage on rot. On January 10th, four potatoes with rot were taken from a bin, 4 from a crate, and 4 from a sack. All were cut open and the superficial rot tissue removed. Three of each lot were returned to their original place and the fourth kept in the office in one corner of the building. Here the night temperature ran as low as freezing and the day about 60; day humidity was found by several tests to be around 50.

When the storage lots were opened March 1-15 the tubers in all three types of storage were found to have rot which had spread and deepened. Those stored in bins were somewhat worse and those in crates least rotted. In the office all lots dried up and suberized without further rot.

Two sound potatoes cut and left in the bins for the same period developed mold but did not rot.

6. Sprouting

The first signs of sprouting were observed on February 23 and then only in a few potatoes in one of the bins. Crates and bags showed signs of sprouting somewhat later but varied according to location; those in the center of the house became active sooner than those nearer the walls.

There was little difference in the various lots at the time of shipping and in few cases were any sprouts more than ¼ inch at this time. The crates were best from this point of view, the bins had most, and the sacks were intermediate.

From the standpoint of seed storage it may be concluded that the matter of sprout prevention is practically solved and that conditions in this respect are immeasurebly better than in any previous year.

7. Shriveling

This was observed February 10 in crates on the lower floor; it was then noted in the upper tier, but was found to be present all thru the lot when they were taken out for shipment. These crates were in the central part of the room; another lot of crates kept near the side wall showed practically no shriveling when sorted.

A slight shriveling was also noted on February 13 in the outside sacks of a sack storage pile near the center of the building.

There was practically no shriveling in bins. In all cases the amount of shriveling was slight.

8. Rots and Sortouts in Seed

The following data covers 7 lots of seed certified from the Coudersport warehouse and 6 from farm storage in the county.

It is to be noted that the figures of rots, etc., given are not strictly comparable since the warehouse stock was graded when stored and there was thus removed from it a great many injured or imperfect tubers which would not be taken out of cellar stored potatoes, it being customary to put the crop in the cellar in the fall and grade in spring. The data given was obtained by Mr. John Hudock during the grading inspections.

RECORD OF SORTOUTS AND ROTS FROM CERTIFIED SEED POTATOES IN POTTER COUNTY, 1925 GRADING INSPECTION

COUDERSPORT STORE HOUSE

No.	Bushels Inspected	Type of Storage	Graded When Stored	% of Sort-outs	% of Active Rot
1	754	Bags	Yes	29.3	2.3
2	846	Crates	Yes	12.8	1.2
3	442	Bags	Yes	30.	2.6
4	350	Crates	Yes	36.	16.2
5	1,200	Bags	Yes	20.	6.
6	250	Bags	Yes	40.	10.8
7	100	Bags	Yes	25.	2.9

FARM CELLAR STORAGE

1	404	Bin	No	28.8	11.1
2	79	Bin	No	30.3	11.3
3	95	Bin	No	7.37	0.16
4	96	Bin	No	29.1	2.9
5	250	Bin	No	17.6	2.99
6	700	Bin	No	28.5	0.85

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WILLIAMSPORT, PA.

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